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A NEW VARIETY OF *VERNONIA LINDHEIMERI*¹

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A very interesting *Vernonia* was collected by Roxana S. Ferris and Carl D. Duncan along the Sanderson-Sheffield Road, twelve miles from Sanderson, Terrell County, Texas, July 19, 1921. The plant was distributed as *Vernonia Lindheimeri* Gray & Engelm.; but upon critical study and comparison with a relatively large suite of specimens representing this species in the Missouri Botanical Garden Herbarium, the Ferris and Duncan plant shows such marked variation from the type of the species that it seems worthy of recognition as an outstanding variety. A description is recorded as follows:

Vernonia Lindheimeri Gray & Engelm. var. *leucophylla*
Larsen, n. var. Pl. 45.

Formae typicae habitu simili; foliis utrinque dense albido-tomentosis; involucri squamis lineari-lanceolatis, acutis, dense tomentosis, marginibus purpurascentibus; achaeniis circiter 4 mm. longis, glabris.

Suffruticose, stem densely tomentose; leaves linear to linear-lanceolate, 4-16 cm. long, 3-8 mm. broad, entire, densely tomentose on both surfaces, margins of the younger leaves occasionally revolute; inflorescence terminal, branching, spreading, leafy; heads 12-17 mm. high; involucre broadly campanulate, 4-5-seriate, 8-9 mm. high and 8-10 mm. in diameter; bracts linear-lanceolate, acute, purple-margined and densely tomentose; heads 50-60-flowered; flowers purple; pappus white; achenes

¹ Issued December 22, 1928.

about 4 mm. long, glabrous and glandless or rarely bearing a few glands in the furrows.—TEXAS: collected along the Sanderson-Sheffield Road, twelve miles from Sanderson, Terrell County, July 19, 1921, *Roxana S. Ferris & Carl D. Duncan 2826* (Mo. Bot. Gard. Herb. No. 902145 TYPE).

Vernonia Lindheimeri Gray & Engelman has been recorded heretofore only from Texas. It is noteworthy, however, that specimens of this species were collected in pine woods about Texarkana, Arkansas, August, 1881, by the late Mr. George W. Letterman. This collection extends considerably the geographical range of the species, which, from material in the Missouri Botanical Garden Herbarium, may now be given as from southern Arkansas in the region of Texarkana southwestward to Sweetwater and San Antonio, Texas.

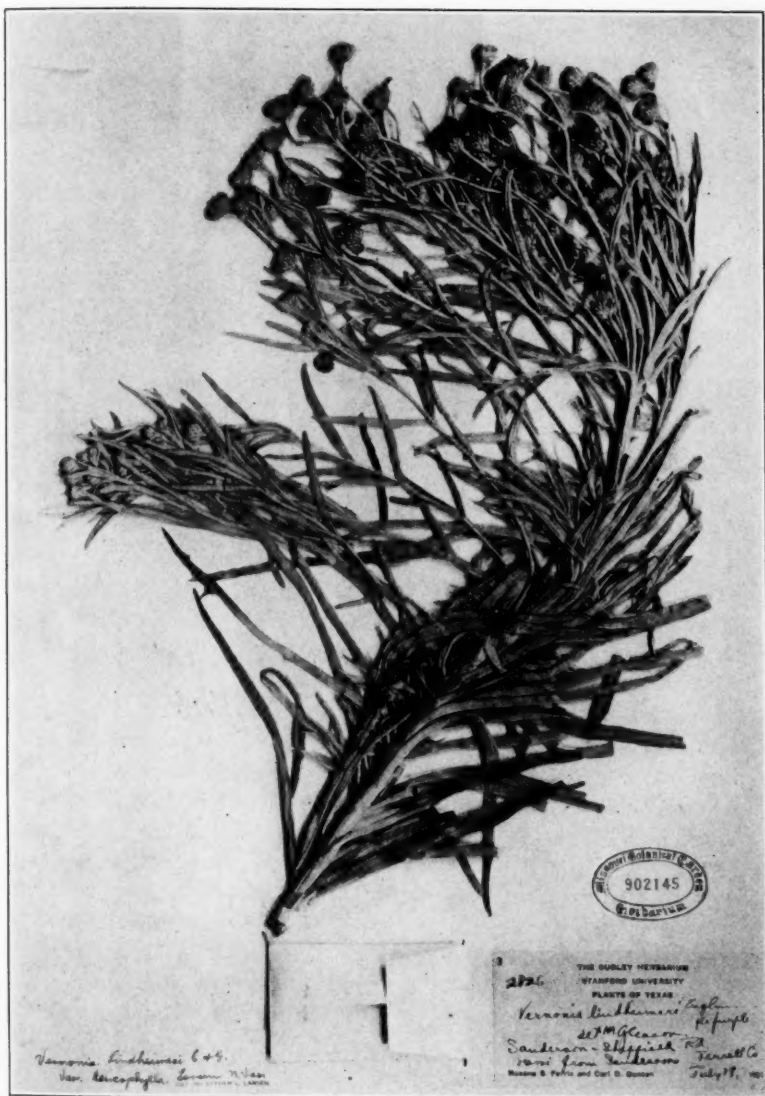
The variety *leucophylla* at the present time is known only from Terrell County, Texas, which is about 200 miles west of the westernmost station recorded for the species. The distribution areas of *Vernonia Lindheimeri* and its variety *leucophylla* in all probability on further exploration will be found to overlap.

EXPLANATION OF PLATE

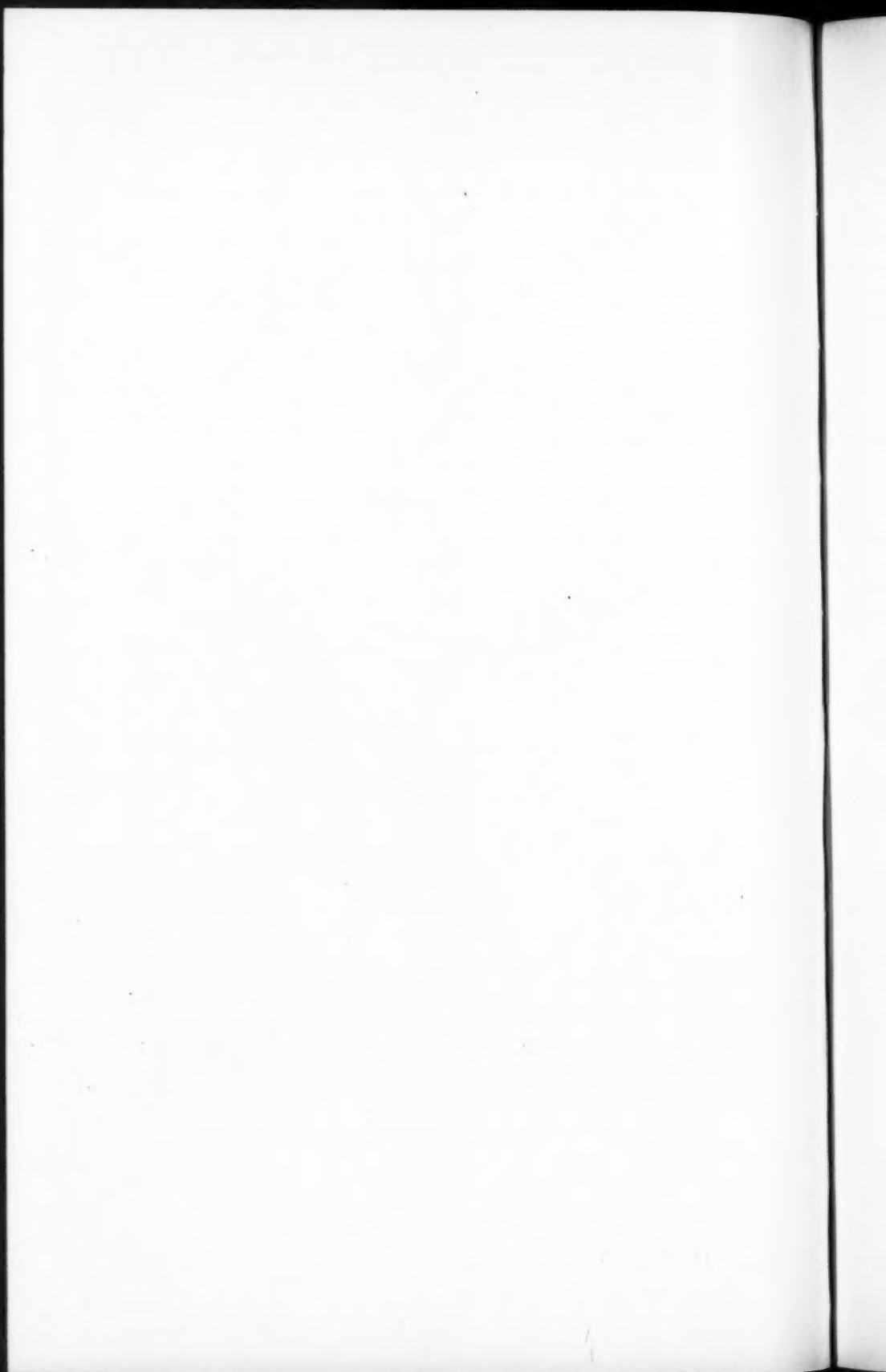
PLATE 45

Vernonia Lindheimeri Gray & Engelman var. *leucophylla* Larsen
Texas

From the type specimen, *Ferris & Duncan No. 2826*, in the Missouri Botanical Garden Herbarium.



LARSEN—NEW VARIETY OF VERNONIA LINDHEIMERI



DYSOSMA: A NEW GENUS OF BERBERIDACEAE¹

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While examining herbarium material of the genus *Podophyllum* in the Gray Herbarium of Harvard University recently, the writer happened upon six sheets of a very curious plant collected in China by Henry in 1854, and also two sheets of similar specimens collected by Ford, and distributed from the Hong-kong Botanic Garden in 1885.

The plants were immediately perceived to be radically distinct from both the North American *P. peltatum* L. and the Asiatic *P. Emodi* Wall. The evident differences are larger size in general, much broader leaves with very shallow and regular lobing, and especially an umbel of four to nineteen flowers instead of the familiar solitary flower of the more common species. Upon a consultation of the literature, it was found that the plants correspond to the description of *P. versipelle* Hance.

A somewhat closer superficial examination disclosed the facts that the pedicels of the inflorescence are distinctly recurved, while those of the more familiar species are erect or slightly nodding, and that the petals are also drooping, oblong-lanceolate in outline, and of a dull reddish color. A difference in the rhizome was also evident, it being thick and fleshy and destitute of scales, with the nodes crowded together almost as a tuber, while the rhizomes of both *P. peltatum* and *P. Emodi* are more like the ordinary creeping stem, if such a distinction can be made, being slender, more fibrous, and giving rise to a conspicuous production of cataphyllary scales (pl. 46, figs. 5 and 10).

Dissections of the species in question disclosed further facts of considerable interest. The stamens of *P. versipelle* are four to six in number, fewer than in the other species, and are about one-half again as large in every dimension as those of both *P. peltatum* and *P. Emodi*. The filaments are sharply curved

¹ Issued December 22, 1928.

away from the pistil, unguiculate in a certain manner, and the sterile connective is greatly developed, apicately produced at the apex, and bears the thin locules conspicuously extended in a parallel position from its ventral side. The anthers, moreover, are introrse, one of the most striking features of the species, since the anthers of all other Berberidaceae are extrorse, including those of *P. peltatum* and *P. Emodi* which are also produced laterally from a narrow connective upon straight filaments. Upon an examination with a compound microscope the pollen of *P. versipelle* was found to be perfectly spherical, and about one-half to two-thirds the size of the lobed pollen of *P. peltatum* and *P. Emodi*.

The pistil of *P. versipelle* also produces a definite slender style bearing a globose stigma, while the other two species have peltate stigmas which are sessile or only slightly elevated. The mature fruit of *P. versipelle* is unknown, but it is presumed to be rather similar to the pulpy bacca of *P. peltatum* and *P. Emodi*.

With two such distinct elements as are represented by *P. versipelle*, on the one hand, and *P. Emodi* and *P. peltatum*, on the other, it appears that the equilibrium of the Berberidaceae and the tribe Podophylleae, containing at present only the genus *Podophyllum*, should be more easily maintained by recognizing the elements as distinct genera of a single tribe, since two such genera would be quite as distinct in their separate tribe as those of the other tribes of the family, as, for instance, *Berberis* and *Mahonia*, and *Epimedium* and *Vancouveria* in the Berberideae.

In establishing the new genus, the name *Dysosma* has been constructed from the Greek $\delta\upsilon\varsigma$ + $\sigma\sigma\mu\acute{\eta}$, signifying "a disagreeable odor," chosen arbitrarily upon the testimony of Hance, who was able to examine fresh plants, and who pronounced their odor as most remarkably putrid.

Tabulated, the differences of *Dysosma* and *Podophyllum* have been found to be as follows:

DYSOSMA	PODOPHYLLUM
Rhizome tuberous, without cataphyllary scales or prophylls.	Rhizome a creeping slender stem, with both cataphyllary scales and prophylls.
Flowers in umbels.	Flowers solitary.

DYSOSMA

Pedicels reflexed.

Petals drooping, dull reddish.

Pistil with a definite style.

Stigma globose.

Stamens 4-6, introrse.

Stamens with an enlarged sterile connective.

Filaments unguiculate, spreading away from the pistil.

Leaf-lobes shallow and regular, sharply and regularly denticulate.

Pollen spherical, relatively small.

PODOPHYLLUM

Pedicels erect or only slightly nodding.

Petals spreading, white.

Pistil without a definite style.

Stigma peltate.

Stamens 6-18, extrorse.

Stamens without an enlarged sterile connective.

Filaments straight, not spreading.

Leaf-lobes deep and irregular, entire or irregularly lacinate.

Pollen lobed, relatively large.

An examination of the literature of the many-flowered *Podophyllums* published from Asia discloses the fact that six species have been described, differing from one another by dissimilarities strikingly analogous to those variable characteristics frequently found in *P. peltatum* and *P. Emodi*,¹ such as the position of the flowers, pubescence, lengths of stamens, and even carpellary number. The specific features of *P. Veitchii* and *P. difforme*, for example, are stamens slightly longer than the petals, and stamens half as long as the petals, respectively; supposed to differ from *P. versipelle*, which is presumed to have stamens and petals of equal length. Upon examination of herbarium² material the writer has been fortunate to find a specimen with two flowers remaining upon the pedicels of the inflorescence, one with stamens longer, and the other with stamens somewhat shorter than the petals (*Henry 5372F*, MBG). Likewise, petals have been found to be notched in a manner similar to that described for *P. Onzoi*. *P. Esquirolii*, furthermore, is said to

¹ A paper dealing with the morphological variability and the involved synonymy which it has produced in the genus *Podophyllum* is now in manuscript.

² In the taxonomic treatment which follows, the herbaria from which exsiccatae have been cited are abbreviated as follows: Gray Herbarium (GH); Missouri Botanical Garden Herbarium (MBG); New York Botanical Garden Herbarium (NY); United States National Herbarium (US). The writer desires to express his appreciation for the facilities which were kindly allowed him by the respective curators of each.

have leaves which are almost without lobing, a feature which might be explained by the great leaf variability of *P. peltatum* and *P. Emodi*. Although predominately extra-axillary, the inflorescence of *Dysosma* has been occasionally found to be axillary. Although perhaps taking too much liberty in doing so, it has been thought advisable in the establishment of the new genus to treat the species described upon such characters as have been found spontaneously variable in *P. peltatum* and *P. Emodi* as representing variations of a single species. Since axillary forms have been reported only from Formosa, it may well be that the position of the umbel is not variable and that the axillary forms are specific. Until better knowledge is available, however, the extra-axillary form is taken as the normal, and the axillary as the abnormal form. Although future study may hold other species genuine, only one, the oldest, which happens to be *P. pleianthum* Hance, has been retained and transferred to *Dysosma*.

*Dysosma*¹ n. gen.

Herbaceous caulescent perennial, glabrous or somewhat pubescent. Rhizome indeterminate, thickened, fleshy, without cataphyllary scales or prophylls. Leaves 1 or 2, peltate, palmately lobed, the lobes regular, usually 6 large anterior and 2 smaller posterior lobes, regularly denticulate. Flowers in axillary or extra-axillary umbels of 4-19, the pedicels reflexed. Petals usually 6, oblong-lanceolate, dull reddish, drooping. Sepals 3, petaloid, fugaceous. Stamens usually 6; filaments long, unguiculate, spreading from the pistil; anthers 2-celled, dehiscing longitudinally, ventrally parallel, produced from an enlarged

¹ *Dysosma* Woodson gen. nov. Berberidacearum, herba perennis caule erecto glaberrimo pruinoso 3-5 dm. alto; foliis radicalibus solitariis caulinis binis crassiusculis centrice vel subcentrice peltatis orbiculatis palmatis 6-8-lobatis, lobis late triangulo-oblongis acuminatis vix quintam diametri partem aequantibus, margine creberrime subulato-denticulatis, petiolis pruinosis aequilongis; pedicellis declinatis; floribus 4-19 ad apicem caulis infra foliam superius petiola vel inter folia apice caulis nascentibus, ebractentis; sepalis 3 tantam deciduis; petalis 6-9 oblongis acutis sordide sanguineo-rubris 1.5 cm. longis; stamine 4-6 antheris valvula longitudinali utrinque dehiscentibus introrsis, filamentis unguiculatis aequilongis connectivo ultra loculos in apiculum producto; ovario ellipsoideo-sphaerico gracilibus stigmatibus globosis cristatis coronatis, ovulis indefinitis.

apiculate sterile connective, introrse. Ovary oblong in outline, 1-celled; ovules many, anatropous, each enclosed in a fleshy aril, disposed upon a lateral placenta; stigma globose, thick, produced upon a definite style. Mature fruit unknown, probably a fleshy berry. Type, *Henry 5372F*, Sze-chuan, China, 1885-88 (MBG).

Type species: *Dysosma pleiantha* (Hance) Woodson.

1. *Dysosma pleiantha* (Hance) Woodson, n. comb. Pl. 46.

Podophyllum pleianthum Hance, Jour. Bot. 21: 175. 1883.

Podophyllum versipelle Hance, l. c. 362. 1883.

Podophyllum Veitchii Hemsl. & E. H. Wils., Kew Bull. Misc. Inf. 1906: 152. 1906.

Podophyllum difforme Hemsl. & E. H. Wils., l. c. 1906.

Podophyllum Esquirolii Léveillé in Fedde, Repert. 11: 298. 1912.

Podophyllum Onzoi Hayata, Icon. Pl. Form. 5: 2. 1915.

Characters of the genus.

Distribution: southeastern China and the island of Formosa.

Specimens examined:

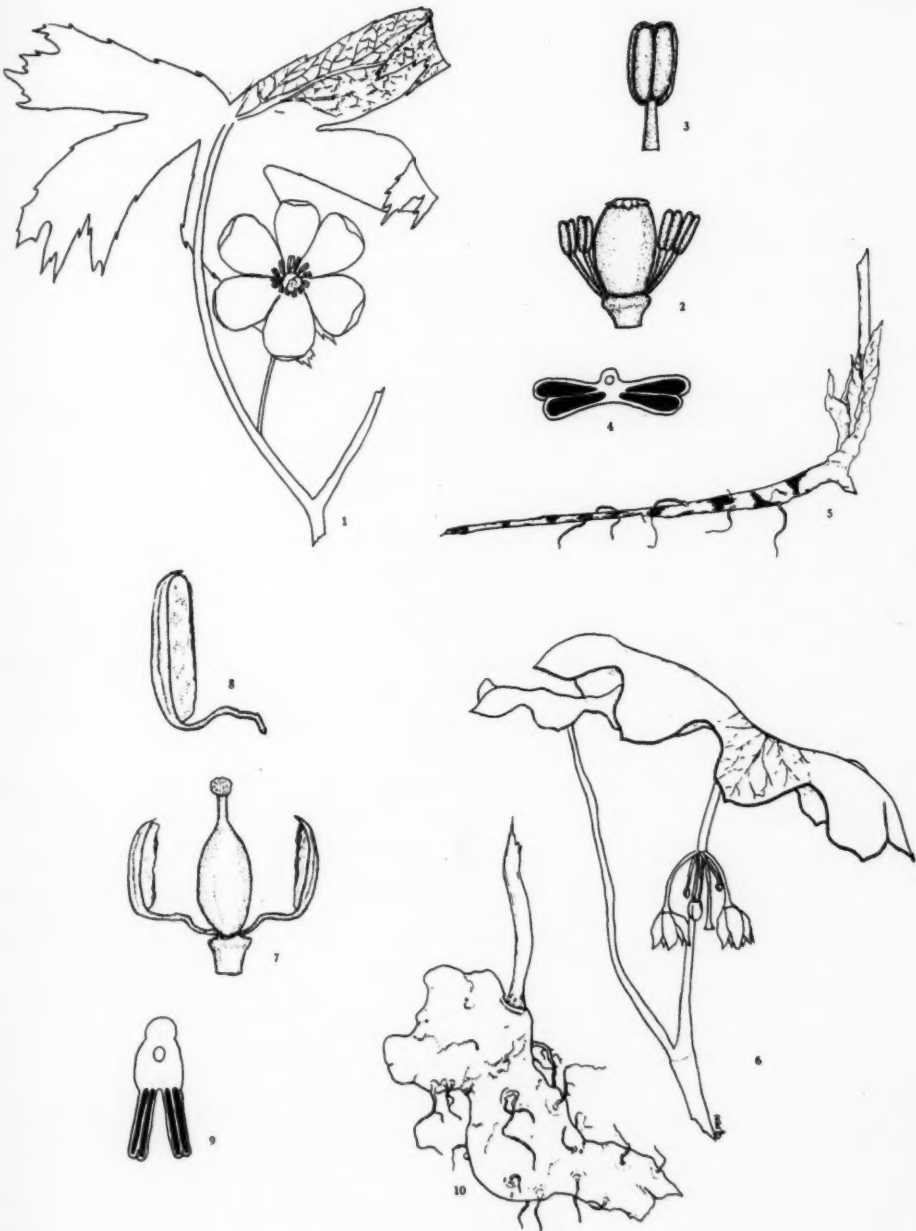
CHINA: Hupeh, April, 1885, *Henry 3952* (GH, US); data lacking, Hongkong Botanic Garden, *Ford* (GH); Canton, Lo-fanshan Mts., date lacking, *Ford 1092* (US); Sze-chuan, 1885-88, *Henry 5372* (GH, MBG TYPE, NY, US); Chekiang, 1903, *Barchet 24* (US); Chekiang, 1906, *Barchet* (US); western Hupeh, May, 1907, *Wilson 3202* (US).

EXPLANATION OF PLATE

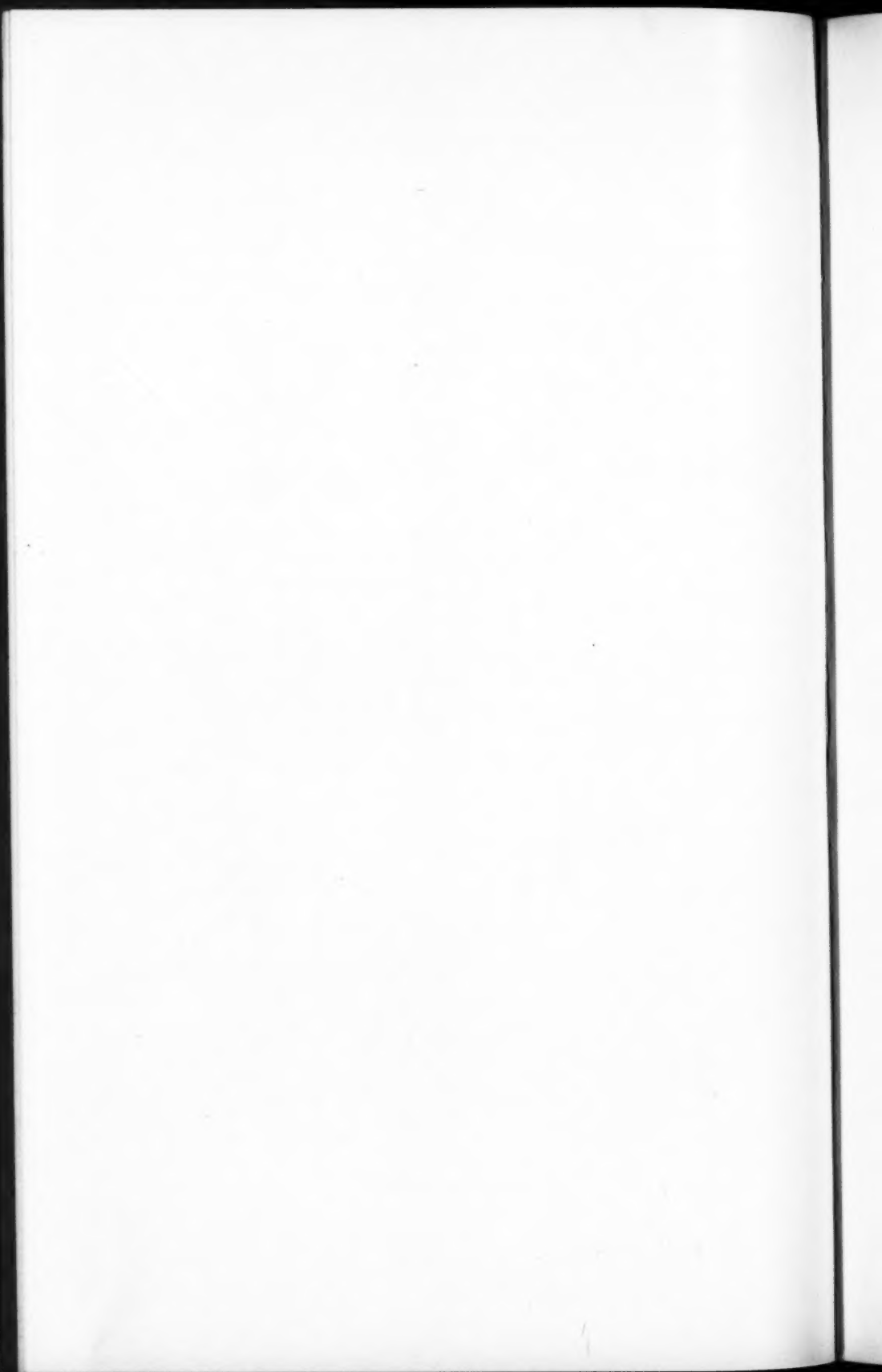
PLATE 46

Comparative morphology of *Podophyllum* and *Dysosma*.

- Fig. 1. Habit of *Podophyllum Emodi* Wall.
- Fig. 2. Receptacle of *P. Emodi* with pistil and four stamens.
- Fig. 3. Stamen of *P. Emodi*.
- Fig. 4. Diagrammatic cross-section of stamen of *P. Emodi*.
- Fig. 5. Rhizome of *P. Emodi*.
- Fig. 6. Habit of *Dysosma pleiantha* (Hance) Woodson.
- Fig. 7. Receptacle of *D. pleiantha* with pistil and two stamens.
- Fig. 8. Stamen of *D. pleiantha*.
- Fig. 9. Diagrammatic cross-section of stamen of *D. pleiantha*.
- Fig. 10. Rhizome of *D. pleiantha*.



WOODSON—DYSOSMA



STUDIES IN THE APOCYNACEAE. II¹

A REVISION OF THE GENUS *STEMMADENIA*

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HISTORICAL REVIEW

The Apocynaceous genus *Stemmadenia* was established in 1844 by Benth², who recognized three species, the type, *S. glabra*, *S. pubescens*, and *S. mollis*. The first and third species were entirely new to science, but the second Benth² perceived to be identical with *Bignonia* ? *obovata* Hook. & Arn.³, although he chose to give the species an original name. The specific adjective of Hooker and Arnott has subsequently been restored by Schumann.⁴

In 1853, A. Richard,⁵ evidently unaware of Benth²'s genus, published the genus *Odontostigma*, with one species, *O. Galeotiana*, from the environs of Havana, Cuba. From the evidence of an excellent plate which illustrates Richard's genus, Miers,⁶ in 1878, was able to definitely identify *Odontostigma* as representing merely another element of *Stemmadenia*.

Thirty-four years after the establishment of the genus by Benth², Miers⁷ presented a treatment of *Stemmadenia* in his monograph of the South American Apocynaceae. In the treatment of Miers, besides the three species of Benth², five new

¹ Studies in the Apocynaceae. I, containing an historical account of the taxonomy of the family and a critical study of the tribe Apocynae, is in manuscript, and will appear in a subsequent number of the ANNALS OF THE MISSOURI BOTANICAL GARDEN.

² Benth. Bot. Voy. Sulph. 124. t. 44. 1844.

³ Hook. & Arn. Bot. Beechey's Voy. 439. 1841. Concerning the mistake of the *Stemmadenia* for a *Bignonia*, Benth² wrote: "A portion of the seed vessel and seeds of a *Pithecoctenium*, probably *P. muricatum*, had been by mistake laid by Dr. Sinclair into the same sheet with the specimen of this plant, and had misled the authors of the 'Botany of Captain Beechey's Voyage' and induced them to refer the plant doubtfully to *Bignonia*." Benth., l. c. 125. 1844.

⁴ K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. 4²: 149. 1895.

⁵ A. Rich. in Sagra, Hist. Cub. 11: 868. t. 56. 1853.

⁶ Miers, Apoc. S. Am. 76. 1878.

⁷ l. c. 74-77. 1878.

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species are added to the genus, namely, *S. grandiflora* (*Tabernaemontana grandiflora* Jacq.), *S. insignis*, *S. Galeottiana* (*Odontostigma Galeottiana* A. Rich.), *S. bella*, and *S. bignoniaeflora* (*Echites bignoniaeflora* Schl.). Of these, the most important by all means is *S. grandiflora*, which introduced a very distinct element into the genus and which, in this revision, is considered to merit subgeneric distinction.

The work of Miers, which was the last to review the genus, was largely but a compilation of the descriptions of plants which the author himself had never seen, and since he had been able to examine only three of the eight species which he recognized, his product is liable to frequent errors, to obviate which will be in part the duty of this revision.

Since the treatment of Miers, several species have been added to the genus, and explorative activity in Central and South America has greatly augmented representatives of the genus in herbaria. In the course of recent determinative work on miscellaneous American Apocynaceae, an encounter with the technical and nomenclatorial difficulties of *Stemmadenia* has convinced the author that a revision of the genus might appropriately be introduced into this series of Studies in the Apocynaceae.

The study entailed in the preparation of this revision was begun at the Gray Herbarium of Harvard University and completed at the herbarium of the Missouri Botanical Garden. The author desires to express his appreciation to Dr. B. L. Robinson and to Dr. J. M. Greenman for assistance and suggestions during the course of the study, and to Dr. George T. Moore for the privileges of the Missouri Botanical Garden. He is also indebted to Dr. N. L. Britton and Mr. Percy Wilson, of the New York Botanical Garden, Dr. F. W. Pennell, of the Philadelphia Academy of Natural Sciences, Dr. W. R. Maxon and Mr. E. P. Killip, of the United States National Herbarium, and to Mr. P. C. Standley and Mr. J. F. Macbride, of the Field Museum, for the courtesy of study in the various herbaria.

GENERAL MORPHOLOGY

The various species of *Stemmadenia* are shrubs or small trees attaining a height of two to twelve meters.

Leaves.—The leaves of the genus are opposite, membranaceous, entire, penninerved, glabrous or pubescent, and petiolate. The sheaths of the petioles are conspicuous, meeting in a shallow ring about the stem. Numerous fusiform glands are concealed in the petiolar ring of the leaves, but are fully exposed and persistent when the leaf drops from the stem. The presence of these glands has been overlooked by each previous student of the genus.

The outline of the leaf varies little, the most frequent form being ovate-oblong. However, variations occur in the spatulate leaves of *S. Donnell-Smithii* and the lanceolate leaves of *S. eubracteata*. The surface of the leaves is extremely variable, and may grade upon the same specimen of certain species from tomentose, through barbate, to glabrous. In the case of other species, however, the surface of the leaves is relatively constant.

The length of the petiole appears of some constancy, and is occasionally used as an accompanying taxonomic criterion.

Inflorescence.—The inflorescence is a reduced terminal cyme, bearing from one to several flowers usually, and three inconspicuous bracts upon the pedicel of each flower. The ordinary well-developed inflorescence of the majority of species of the genus produces four to ten flowers, but an exception is found in the case of *S. pauciflora* which normally develop but one flower for each cyme, although one to several abortive buds may appear.

The bracts usually directly subtend the flower, but in certain species, as in *S. eubracteata*, may appear about midway upon the pedicel. The character of the bract is a differentiating criterion between the genera *Tabernaemontana* and *Stemmadenia*, since in the former genus the bract always subtends the pedicel or aborts entirely.

Calyx.—The calyx consists of five imbricate lobes of unequal size, the three interior being somewhat larger, and usually more nearly colorless than the two smaller exterior lobes. Upon the interior of the calyx-tube, near the attachment to the disc, are borne several cycles of small fusiform glands, which may vary in approximate number from fifty to over one hundred. The unequal lobes of the calyx and the unusual number of the calycine glands are obvious distinguishing marks of the genus.

The relative length of the calyx-lobes and the general size of the calyx are of basic importance in the speciation of the genus, and form at once an evident, and it is believed a reliable and natural, taxonomic criterion. The lobes may vary from 2 cm. in some species to 1 mm. long in others, and are usually distinct for the various species.

Corolla.—The genus *Stemmadenia* is at once divisible into two subgenera largely upon the basis of the form of the corolla. The sections are also based upon this character. The corolla is salverform in the subgenus *Ochrodaphne*, and infundibuliform in the subgenus *Eustemmadenia*. The salverform corollas of *Ochrodaphne* are fairly regular, but the infundibuliform corollas of *Eustemmadenia* divide into two series, namely, that of the section *obovatae*, with a conical proper-throat and a spirally twisted tube, and that of the section *Galeottiae*, with a cylindrical proper-throat and a tube without spiral twisting. The relation of the proper-throat to the proper-tube of the infundibuliform corollas is again apparently a matter of taxonomic importance in the case of certain species, as is also the length of the limb.

Within the corolla-tube, above and opposite the attachment of the stamens, are five conspicuous appendiculate folds which vary considerably in length, but are constant for the genus.

The corollas are large and showy, and are either yellow or yellowish white in color. The five equal lobes of the limb are dextrorsely deflexed, especially in the subgenus *Ochrodaphne*.

Stamens.—The five stamens are wholly inserted, and are attached to the corolla-tube by short, thick, unguiculate filaments. The two sporangia comprising the anthers are elongate-fusiform in shape, and may be practically parallel, as in the subgenus *Ochrodaphne*, or obviously divergent at the base of the anther, as in the subgenus *Eustemmadenia*. The anthers are entirely fertile and unappendaged.

Pistil.—The pistil is typically bi-carpellate. The carpels are sessile and are separate except at the apices, which connive to form the filamentous style. Each carpel is uniloculate and contains many ovules upon a binate ventral placenta. The stigma is borne upon a fleshy terminal clavuncle.

Disc.—The disc proper is inconspicuous, shallow, and im-

mersed, but is surmounted by a ring of five conspicuous fleshy nectaries about the pistil, which, however, are actually coalesced into a more or less unified ring. The nectaries are partially adnate to the walls of the carpels, at least at the base. The nectaries appear of little taxonomic use.

Fruit.—The fruit consists of a pair of divaricate, leathery, glandular-punctate follicles containing many striate, albuminous, ecomose seeds immersed in an oily arilar pulp. The leathery pericarp eventually becomes coriaceous, and appears at that time to undergo a ventral dehiscence. The embryo is straight.

It appears probable that were fruiting specimens of each species abundant peculiar diagnostic characters would be available based upon the general shape and size, form of glandulosity, etc. At present, however, the fruit of relatively few species is known, and in the following keys, the fruit is entirely omitted.

SYSTEMATIC POSITION

Concerning the affinities of the genus *Stemmadenia*, Richard was much better orientated than Bentham. Bentham,¹ in describing the genus, wrote in part: "The size and form of the flowers in the above three species [*S. glabra*, *S. pubescens*, and *S. mollis*] are those of a *Cerbera* or a *Thevetia* from both of which, however, they differ in the calycine glands, and from the latter in the ovary; and in many points also there is a considerable degree of affinity with *Odontadenia*, but that genus again has not the remarkable calyx and glands of *Stemmadenia* . . ." Since superficially all large flowers resemble one another, Bentham was right in associating his new genus with *Cerbera* and *Thevetia*, although he does not mention the significant differences between those genera and *Stemmadenia*. However, in referring to an affinity with *Odontadenia* the fallibility of the obvious is well demonstrated, for *Stemmadenia*, with unappendaged anthers, non-connivent stamens, fleshy follicles and ecomose seeds, is about as distantly related to *Odontadenia*, with appendaged anthers, connivent stamens, chartaceous follicles, and heavily comose seeds, as two genera in the same family

¹ Benth., l. c. 125. 1844.

could be. More recently Miers,¹ evidently deceived by the external similarity of the flowers of *Stemmadenia* to the showy flowers of the *Echitoideae*, pictured the stamens of *S. insignis* with conspicuous basal appendages.

Richard² displayed an understanding view of the morphology of Apocynaceae genera when, in describing *Odontostigma*, he remarked "Difiere del genero *Thevetia* sobre todo por su caliz, mas ancho y mas largo y por sus ovarios distintos, conteniendo cada uno gran numero de ovulos y no dos ovulos solamente como en el genero *Thevetia*." Miers, in following Richard's carpological view of the subject, has justly associated *Stemmadenia* with *Tabernaemontana*, its nearest relative, but has evidently failed to make sufficiently clear the differences which exist between them.

In summing up the results of recent study, it is clear that *Stemmadenia*, by reason of its unappendaged anthers and non-connivent stamens, is a member of the subfamily Plumeroideae of Apocynaceae. Furthermore, by reason of its two carpels forming a divaricate fruit, it belongs to the tribe Plumereae. Finally, the fleshy follicles ally the genus immediately with the genera *Cerbera*, *Thevetia*, *Vallesia*, and *Tabernaemontana* in the subtribe *Tabernaemontaninae*.

From the genera *Cerbera*, *Thevetia*, and *Vallesia*, *Stemmadenia* differs, as Bentham and Richard have indicated, in the nature of the calycine glands, which are so conspicuously multiplied in *Stemmadenia*, in the calyx, which is conspicuously irregular in the latter genus and regular in *Cerbera* and *Thevetia* and *Vallesia*, and in the fruit, which is monospermous in the latter three genera and polyspermous in *Stemmadenia*. Finally, it is noteworthy that the carpels in *Cerbera* and *Thevetia* develop together, while those of *Stemmadenia* become widely divaricate, in which character it appears related to *Vallesia*.

From the genus *Vallesia*, *Stemmadenia* also differs in the corolla, which is much larger than in the former genus, and in the inflorescence, which is more reduced. The fleshy pericarp of *Vallesia*, also, is watery and evanescent, differing from the leathery persistent pericarp of *Stemmadenia*.

¹ Miers, l. c. pl. 10B. 1878.

² Richard, l. c. 1853.

The differences between *Tabernaemontana* and *Stemmadenia* have not always been easy to perceive. The most conspicuous difference is in the size of the flowers, which is much greater in the latter genus than in the former. However, technical characters are several and concise. The irregularity of the calyx of *Stemmadenia* again sets it apart from the regular calyx of *Tabernaemontana*. The interior of the corolla-tube in *Tabernaemontana* is naked, and contains appendiculate folds in *Stemmadenia*. The calycine glands of the former are uniseriate, while those of the latter are multiseriate. The nectaries of the former are completely coalesced and adnate to the carpels; the nectaries of the latter are only partially coalesced and are scarcely adnate to the carpels. The filaments of the former are straight, while those of the latter are unguiculate. Also it is believed that the fruit of *Stemmadenia*, which is much larger than that of *Tabernaemontana*, is eventually dehiscent along a ventral suture, while that of the latter genus is always indehiscent. The corolla of *Stemmadenia* is infundibuliform, or, if salverform, the tube is spirally twisted and the calyx is immediately subtended by three bracts, while in *Tabernaemontana* the corolla is always salverform, although the tube is not spirally twisted and bracts are limited to one or two, which subtend the pedicel rather than the calyx itself or are lacking.

RELATIONSHIPS WITHIN THE GENUS

As has already been explained, the genus *Stemmadenia* is readily divisible into two subgenera. The subgenus *Eustemmadenia* comprises plants with infundibuliform corollas, the lobes of which are slightly deflexed dextrorsely. The calyx squamellae are in several series. The sporangia of the anthers are divergent at the base.

The species of the subgenus *Ochrodaphne* possess salverform corollas with lobes which are conspicuously deflexed dextrorsely, and auriculate, giving the flower a striking turbinate appearance. The calyx squamellae are fewer than those of *Eustemmadenia* and are usually in only two or three series. The sporangia of the anthers are nearly parallel to the base.

The pistil of *Ochrodaphne*, also, represents a condition much

nearer coalescence of the carpels than that of *Eustemmadenia*. The carpels of *Eustemmadenia* are prolonged into two distinct stylopodium-like beaks before they finally unite into a common style bearing the stigmatic clavuncle. On the other hand, the

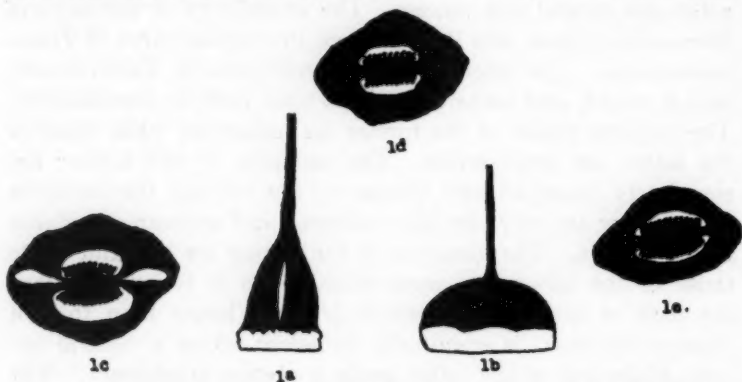


Fig. 1. Carpellary diagrams of *Stemmadenia*. 1a, pistil of *S. tomentosa* var. *Palmeri*; 1b, pistil of *S. grandiflora*; 1c, cross-section of ovary of *S. tomentosa* var. *Palmeri*; 1d, cross-section of ovary of *S. Galeottiana*; 1e, cross-section of ovary of *S. grandiflora*.

style of *Ochrodaphne* arises directly from the summit of the truncate carpels. Diagrams of the pistils of *Eustemmadenia* and *Ochrodaphne* are found in fig. 1, which also diagrams a difference in placentation occurring between the two subgenera.

Eustemmadenia appears to be the more primitive of the subgenera and *Ochrodaphne* the more advanced because of the form of the corollas and pistils of those groups, and also by reason of the reduced calyx-squamellae of the latter. In a future paper reasons for assuming the floral squamellae frequently occurring in the Apocynaceae as staminal vestiges will be fully discussed, and until then the reasons for regarding the reduction of squamellae as a modified rather than a primitive state must remain implied.

For morphological reasons which have already been advanced, *Stemmadenia* is apparently more primitive than its closest neighboring genus, *Tabernaemontana*, and should therefore logically be placed after that genus in a phylogenetic synopsis of the family Apocynaceae. At present, in the system of K. Schu-

mann in Engler and Prantl's 'Naturlichen Pflanzenfamilien,' this order is reversed. This latter order is also found in the 'Genera Phanerogamarum' of Dalla Torre and Harms. The logic of viewing *Stemmadenia* as more primitive rather than more advanced than *Tabernaemontana* is perceived when the genus is split into the two subgenera, *Eustemmadenia* and *Ochrodaphne*, indicating an advance from a simple corolla and numerous squamellae to a more highly modified corolla and reduced squamellae, including an advance in the coalescence of the carpels, tendencies finally developing a climax in the morphology of the genus *Tabernaemontana*.

The species within the group *Ochrodaphne* are homogeneous and not divisible into subgroups, but the species of *Eustemmadenia* are clearly divisible into two sections, illustrating an approach from the infundibuliform corolla characteristic of the subgenus to the salverform corolla of *Ochrodaphne*. Of these, the *obovatae* possess a typically infundibuliform corolla with a nearly conical proper-throat and a dextrorsely twisted tube, while the *Galeottiae* possess a modified form of infundibuliform corolla with a long cylindrical proper-throat, and a tube which is without dextrorse spiral twisting. Apparently the only other morphological difference which accompanies the corollar characters of these sections is the amount of space left between the carpels as an index of the degree to which carpellar fusion has progressed. Figs. 1c and 1d illustrate diagrammatically cross-sections of the pistils of *S. tomentosa* var. *Palmeri* and *S. Galeottiana*, representatives respectively of the sections *obovatae* and *Galeottiae*. It is easily perceived that the carpels of the latter are the more nearly coalesced, which corroborates the judgment of it as the more advanced, phylogenetically. The carpels of the subgenus *Ochrodaphne*, as fig. 1e testifies, are at about the same stage of coalescence as those of the *Galeottiae* section of *Eustemmadenia*.

GEOGRAPHICAL DISTRIBUTION

The genus *Stemmadenia* is confined apparently to the tropical regions of continental America, lying between the Equator and the Tropic of Cancer roughly, although it also occurs slightly more to the north of those arbitrary bounds as far as southern

Chihuahua in Mexico, and doubtless also farther to the south, especially in Ecuador.

The species of the genus are frequenters of sub-Cordilleran underbrush, and range in height from two to twelve meters for mature specimens. The fruit is said by Miers to constitute a favorite food for the larger birds of the region, and seeds are probably distributed by means of those agents.

As fig. 2 indicates, the subgenus *Eustemmadenia* and the subgenus *Ochrodaphne* coincide in their ranges in Central America, but have distinctive ranges, *Eustemmadenia* towards the North, and *Ochrodaphne* towards the South. However, *S. obovata* var. *mollis*, one of the most widespread and common representatives of *Eustemmadenia* sect. *obovatae*, has twice been collected about Guayaquil, Ecuador, and once near Yungas, Bolivia, imparting a most singular appearance to a map of the distribution of the genus. The disrupted nature of the distribution of the subgenus *Eustemmadenia* thus disclosed urges a consideration of it as a relict group; thus as in all probability the more primitive of the subgenera, and the section *obovatae* as the ancestor of the entire group, even as a study of the morphology alone indicated.

Although Richard, in describing *Odontostigma Galeottiana*, stated that the specimens were from the environs of Havana, Cuba, and although one would naturally expect to find representatives of a genus so frequent naturally in Central America in the Antilles, no evidence of the presence of the genus in Cuba or the other Caribbean Islands has been found, either in herbaria or in published floras of the region. It appears probable that Galeotti's specimen from which Richard drew his description was in reality collected in Mexico, rather than in Cuba, as was understood by Richard.

ABBREVIATIONS

In citing specimens, the following abbreviations for herbaria have been employed: G = Gray Herbarium of Harvard University; NY = Herbarium of the New York Botanical Garden; US = United States National Herbarium; ANSP = Academy of Natural Sciences of Philadelphia; F = Herbarium of the Field

Fig. 2.—Showing distribution of species of *Stemmadenia*

Museum of Natural History; MBG = Herbarium of the Missouri Botanical Garden.

TAXONOMY

Stemmadenia Benth. Bot. Voy. Sulph. 124. t. 44. 1844; Lindl. Veg. Kingd. 601. 1847; Walp. Rep. 468. 1847; Pfeif. Nom. Bot. 2: 1270. 1874; Benth. & Hook. Gen. Pl. 2: 707. 1876; Miers, Apoc. S. Am. 74. 1878; Hemsl. Biol. Cent.-Am. Bot. 2: 310. 1881; Durand, Ind. Gen. Phan. n. 4615. 1888; Baill. Hist. Pl. 10: 196. 1891; K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. 4: 148. 1895; Standl. Contr. U. S. Nat. Herb. 23: 1155. 1924. *Odontostigma* A. Rich. (non Zoll. & Mor.) Fl. Cub. Fanerog. 2: 86. 1853.

Stemmaderia B. D. Jackson, Ind. Kew. 2: 331. 1894. err. typ.

Lactescent shrubs or small trees 2-15 m. tall. Leaves entire, opposite, glabrous or pubescent, petiolate, the sheaths of the petioles meeting in a shallow ring about the stem and sheltering in the crux many small fusiform glands. Inflorescence a terminal reduced raceme of several flowers. Corolla large, infundibuliform or salverform, white or yellow, the limb of 5 equal lobes dextrorsely reflexed and occasionally auriculate, bearing 5 linear interior appendiculate folds opposite and slightly above the attachment of the stamens. Calyx 5-parted, the lobes imbricate, unequal, usually 3 larger interior and 2 smaller exterior, bearing several cycles of small fusiform glands within and near the attachment of the disc. Stamens 5, included, attached to the corolla at the summit of the proper-tube, alternate with the corolla-lobes; filaments very short and thick, unguiculate at the attachment to the anthers; anthers of 2 elongate unappendaged sporangia. Carpels 2, sessile, unilocular, bearing many ovules upon a lateral binate ventral placenta, produced apically into a long filiform style; stigma terminal, borne upon a fleshy truncate clavuncle. Disc proper shallow, immersed, entire; nectaries fleshy, coalesced into a more or less irregular ring about, and slightly adnate to, the carpels. Fruit a pair of divaricate, leathery, glandular-punctate follicles containing many striate, albuminous, ecomose seeds immersed in an oily arilar pulp; embryo straight.

Type species: *S. glabra* Benth. Bot. Voy. Sulph. 124. t. 44. 1844.

SYNOPSIS OF THE SUBGENERA AND SECTIONS

KEY TO THE SUBGENERA

- Corolla infundibuliform, the lobes dextrorsely reflexed, but only slightly auriculate; bracts immediately subtending the calyx. Subgen. I. *EUSTEMMADENIA*
 Corolla salverform, the lobes dextrorsely reflexed and very strongly auriculate; bracts placed about midway upon the pedicels. Subgen. II. *OCHRODAPHNE*

SUBGENUS I. *EUSTEMMADENIA* Woodson

Subgenus I. *EUSTEMMADENIA* Woodson, n. subgen.

Corolla infundibuliform, the lobes dextrorsely reflexed and very slightly auriculate; calyx-squamellae in several series of different lengths; sporangia of the anthers divergent at the base; rim of the coalesced nectaries irregularly folded and lobed; corollar appendages relatively long, 1.5–2.0 cm. long; bracts immediately subtending the calyx.

Section 1. *OBOVATAE* Woodson. Proper-throat of the corolla conical, about as long as broad.

KEY TO THE SPECIES

- a. Calyx relatively short, 1–5 mm. long.
 - b. Calyx-lobes oblong to ovate, acute at the apex, 3–5 mm. long.
 - c. Under-surface of leaves persistently and uniformly tomentose. 1. *S. tomentosa*
 - cc. Under-surface of leaves slightly barbate in the axils of the mid-vein, becoming glabrous or glabrate. 1a. *S. tomentosa* var. *Palmeri*
 - bb. Calyx-lobes subreniform, rounded at the apex, 1–2 mm. long. 2. *S. sinaloana*
- aa. Calyx relatively long, 1.5–3 cm. long.
 - b. Proper-tube about as long as the calyx; inflorescence glabrous. 3. *S. glabra*
 - bb. Proper-tube much surpassing the calyx; inflorescence pubescent.
 - c. Upper-surface of leaves glabrate. 4. *S. obovata*
 - cc. Upper-surface of leaves persistently pubescent. 4a. *S. obovata* var. *mollis*

1. *Stemmadenia tomentosa* Greenm. Proc. Am. Acad. 35: 310. 1900; Standl. Contr. U. S. Nat. Herb. 23: 1156. 1924.

Shrubs or small trees, 2–12 m. tall; leaves 8–15 cm. long, 5–7 cm. broad, glabrous or glabrate above, tomentose beneath, petioles 4–8 mm. long; inflorescence 2–5-flowered; corolla yellow, the proper-tube 2–2.5 cm. long, the proper-throat conical,

2-3 cm. long, 1.5-2 cm. broad at the orifice, the limb 2-3 cm. broad; calyx-lobes 4-5 mm. long, the segments oblong to ovate, acute at the apex, somewhat imbricate, both the larger and the smaller yellowish; follicles 4-4.5 cm. long, 3-3.5 cm. broad, acute at the apex.

Distribution: waste-lands, central and southern Mexico.

Specimens examined:

MEXICO:

VERA CRUZ: San Juan, 1889, *Heilprin & Baker* (ANSP).

JALISCO: lava beds near Zapotlan, May 19, 1893, *Pringle 4370* (G TYPE, NY, US, MBG).

SINALOA: Sinaloa, April 2, 1910, *Rose, Standley & Russell 13874* (US).

1a. Var. *Palmeri* (Rose) Woodson, n. comb.

Stemmadenia Palmeri "Kosc." ex Urbina, Pl. Mex. 214. 1897, *nomen*.

Stemmadenia Palmeri Rose ex Greenm. Proc. Am. Acad. 35: 311. 1900.

"*Stemmadenia Palmeri* Rose & Standl." in Standl. Contr. U. S. Nat. Herb. 23: 1156. 1924.

Leaves glabrous or glabrate above, beneath barbate in the axils of the midvein, or glabrate; calyx-lobes 3-5 mm. long, greenish.

Distribution: waste-land, and hedgerows, general over central and southern Mexico.

Specimens examined:

MEXICO:

CHIHUAHUA: Tierras Verdes, May, 1891, *Hartmann 534* (G); southwestern Chihuahua, Aug.-Nov. 1885, *E. Palmer M* (G, US); Batopilas, April, 1892, *Hartmann 1032* (G).

SINALOA: Ymala, Aug. 16-25, 1891, *E. Palmer 1470* (US TYPE); Mazatlan, April 5, 1910, *Rose, Standley & Russell 14064* (US); vicinity of Rosario, April 14, 1910, *Rose, Standley & Russell 14544* (US); San Ignacio, June 19, 1918, *Montes & Salazar 405* (US); Guadalupe, April 18, 1910, *Rose, Standley & Russell 14675* (US); La Cruz, 1921, *Ortega 4175* (US); between Rosario and Concepcion, July 27, 1897, *Rose 3260* (US); San

Ignacio, March 12, 1918, *Montes & Salazar 268* (US); Rosario, July 8, 1897, *Rose 1573* (US); Colomas, July 16, 1897, *Rose 1688* (US).

JALISCO: Baranca, near Guadalajara, June, 1886, *E. Palmer 132* (G, US); Chiquilistlan, May 15, 1892, *Jones 335* (MBG, US); Tequila, July 5-6, 1899, *Rose & Hough 4777* (US); Baranca, near Guadalajara, May 28, 1891, *Pringle 5151* (G); vicinity of Colima, April 5, 1897, *Seler 3436* (G); Baranca of Guadalajara, alt. 4000 ft., June 10, 1898, *Pringle 6872* (G, NY, F, ANSP, US, MBG); Guadalajara, June 25, 1892, *Pringle 5363* (G); San Sebastien, Jan. 15, 1927, *Mezias 1490* (US); Bolanos Aug. 10-19, 1897, *Rose 2888* (US).

DURANGO: Chocala, March 7, 1899, *Goldman 358* (US).

MORELOS: Cuernavaca, May 11, 1898, *Pringle 6847* (US).

NAYARIT: Ojos de Agua, near Ixtlan, Sept. 23, 1926, *Mezias 733* (US).

Popular names of this variety are "Berrarco," "Berraco 6 Tapaco," and the gum of the fruit is said to be used like chicle (*Montes & Salazar 405*, US).

The embarrassment of monographers who find themselves forced to regard as "typical" an anomalous form of a species because of priority in publication over a more common variety is illustrated in a peculiar fashion by *Stemmadenia tomentosa* Greenm. and its var. *Palmeri*. As early as 1891 the herbarium name "*Stemmadenia Palmeri* Rose" was distributed with specimens of the glabrescent or barbate variety of the former species. The name did not appear in publication, however, until 1893, when Urbina, in compiling his 'Catalogue of Mexican Plants,' happened upon specimens of the genus bearing the inscription of *S. Palmeri* Rose in a rather poor script, and erroneously published the name for the first time as a *nomen nudum*. Urbina mistook the name of Dr. Rose for an abbreviation, and gave the author as "Kosc." It is indeed fortunate that a description was not included under that authorship.

In 1900 Dr. Greenman published *Stemmadenia tomentosa*, and in so doing spoke of the characteristics of *S. Palmeri* Rose, which he evidently assumed to be a correctly published name. It was not until 1924 that *Stemmadenia Palmeri* was published

by Rose in Standley's 'Trees and Shrubs of Mexico.' The legal place of publication of the species must evidently be regarded as ex Greenman, Proc. Am. Acad. 35: 311. 1900.

2. *Stemmadenia sinaloana* Woodson, n. sp.¹ Pl. 48, fig. 1.

Shrubs or small trees; leaves 8–12 cm. long, 5–6 cm. broad, glabrous, or very slightly puberulent upon the lower surface, petiolate, the petioles 7–10 mm. long; inflorescence 1–4-flowered; corolla yellow, the proper-tube 1.5–2 cm. long, the proper-throat conical, about 1.5 cm. long, about 1.5 cm. broad at the orifice, the limb 1.5–2 cm. long; calyx about one-sixteenth the length of the proper tube, the segments ovate-reniform, 1.2 mm. long, about 4 mm. broad, obtuse at the apex, or completely rounded, scarcely imbricated, unequal, greenish; follicles unknown.

Distribution: known only from the type locality in Sinaloa.

Specimens examined:

MEXICO:

SINALOA: Rosario, Jan. 1895, *Lamb 467* (G TYPE).

S. sinaloana is especially noteworthy in the genus *Stemmadenia* by reason of its peculiarly reduced calyx. In that respect it is closest related to *S. tomentosa* Greenm., from which it differs in having a calyx less than one-half as large (1–2 mm. long), and in having the calyx-lobes subreniform and rounded at the apex instead of oblong and ovate with acute or acuminate apex as in the latter species.

3. *Stemmadenia glabra* Benth. Bot. Voy. Sulph. 124. t. 44. 1844; Hemsl. Biol. Cent.-Am. Bot. 2: 310. 1881; Miers, Apoc. S. Am. 74. 1878; K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. 4²: 149. 1895; Standl. Contr. U. S. Nat. Herb. 23: 1156. 1925; Standl. & Calderón, Lista Prélim. Pl. Sal. 174. 1925.

Pl. 47, fig. 1.

Shrubs or small trees, 2–10 m. tall; leaves 14–20 cm. long, 7–8 cm. broad, glabrous, petiolate, petioles 5–10 mm. long;

¹ *Stemmadenia sinaloana* sp. nov., arborea glabra vel subpuberulenta; foliis oblongo-lanceolatis 8–12 cm. longis 5–6 cm. latis; petiolis 7–10 mm. longis; corollae tubo conico-infundibuliformo 3–3.4 cm. longo, lobis ca. 1.5 cm. longis; calycis lobis parvis ovato-reniformibus inaequalibus ca. 2 mm. longis ca. 4 mm. latis obtusis, viridibus.—Sinaloa, Rosario, Jan. 1895, *F. H. Lamb 467* (Gray Herb., TYPE).

inflorescence 1-4-flowered; corolla deep yellow, the proper-tube 2-2.5 cm. long, the proper-throat conical, about 2 cm. long, 2-2.5 cm. broad at the orifice, the limb 2.5-3 cm. long; calyx about equalling the length of the proper tube, the segments 1.5-2.5 cm. long, .8-1.0 cm. broad, strongly imbricate in two unequal series, the larger yellow, the smaller greenish yellow; follicles about 5 cm. long, 3-3.5 cm. broad.

Distribution: tropical forests and thickets, Central America. Reported also from Mexico.

Specimens examined:

COSTA RICA: between San Pedro de Montes de Oca and Curidabat, Dept. San José, Feb. 2, 1924, *Standley 32793* (US); Cartago, Feb. 1924, *Standley 35459* (US).

HONDURAS: Amapala, Isla de Tigre, Feb. 14, 1922, *Standley 20713* (US).

EL SALVADOR: vicinity of La Unión, Dept. La Unión, alt. 150 m., Feb. 13-21, 1922, *Standley 20686* (G, NY, US); Laguna de Magugüe, Dept. La Unión, alt. 60 m., Feb. 18, 1922, *Standley 20943* (G, NY, US); La Unión, Sept. 21, 1860, *Sutton-Hayes* (G).

NICARAGUA: southwestern slopes of Santiago Volcano, near Masaya, alt. 300-480 m., July 5, 1923, *Maxon 7647* (G, US); Ometepe Island, Jan. 1893, *C. L. Smith* (G); Managua, shores of Lake Managua, June 24, 1923, *Maxon, Harvey & Valentine 7270* (US); Managua, vicinity, June 30, 1923, *Maxon, Harvey & Valentine 7539* (US); Laguna de Masaya, July 6, 1923, *Maxon 7727* (US).

Dr. Sutton Hayes remarks (*Sutton-Hayes*, G) that the popular name of this species in El Salvador is "Cajon del Mico." According to Standley (*Standley 32793*, US), the popular name in Costa Rica is "huevos de Caballo," or "Girijarro," and the sap is used for corns and tooth-ache.

4. *Stemmadenia obovata* (Hook. & Arn.) K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. 4²: 149. 1895.

Bignonia (?) *obovata* Hook. & Arn. Bot. Beech. Voy. 439. 1841.

Stemmadenia pubescens Benth. Bot. Voy. Sulph. 125. 1844;

Miers, Apoc. S. Am. 74. 1878; Hemsl. Biol. Cent.-Am. Bot. 2: 310. 1881.

Shrubs or small trees, 2-15 m. tall; leaves 10-20 cm. long, 7-10 cm. broad, pubescent, or glabrate above, petiolate, petioles 5-8 mm. long; inflorescence 1-6-flowered; corolla deep yellow, the proper-tube 1.5-2.5 cm. long, the proper-throat 1.5-3 cm. long, 2-2.5 cm. broad at the orifice, the limb 1.5-2.5 cm. long; calyx much surpassed by the length of the proper-tube, the segments 1.5-2 cm. long, .8-1.0 cm. broad, strongly imbricated in two unequal series, both series yellowish; follicles 4-4.5 cm. long, 3-3.5 cm. broad, acute at the apex.

Distribution: tropical forests and thickets, southern Mexico and Central America.

Specimens examined:

MEXICO:

GUERRERO: El Correo, alt. 900 m., May 18, 1899, *Langlassé 1029* (G).

COSTA RICA: Salinas, July, 1890, *Pittier 1177* (US).

NICARAGUA: Managua, vicinity, June 30, 1923, *Maxon, Harvey & Valentine 7542* (US); La Paz, Dept. Leon, Jan. 31, 1903, *Baker 2270* (G, US); Managua, June 30, 1926, *Chaves 215* (US).

EL SALVADOR: near La Cebadilla, 1922, *Calderón 1230* (G); Laguna de Olomega, Dept. San Miguel, alt. 75 m., Feb. 20, 1922, *Standley 21034* (G).

4a. *Var. mollis* (Benth.) Woodson, n. comb.

Stemmadenia mollis Benth. Bot. Voy. Sulph. 125. 1844; Hemsl. Biol. Cent.-Am. Bot. 2: 310. 1881; Miers, Apoc. S. Am. 75. 1878; K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. 4²: 149. 1895; Urbina, Pl. Mex. 214. 1897; Donn.-Sm. Enum. Pl. Guat. 4: 105. 1895; Areschoug, Pl. ca. Guayaquil Coll. 127. 1910; Standl. Contr. U. S. Nat. Herb. 23: 1156. 1924; Standl. & Calderón, Lista Prélim. Pl. Sal. 174. 1925.

Stemmadenia calycina Brandg. Univ. Cal. Publ. Bot. 10: 188. 1922.

Upper surface of leaves persistently tomentose.

Distribution: tropical forests and hedgerows, southern Mexico, northern Central America, and northwest-central South America.

Specimens examined:

MEXICO:

VERA CRUZ: Baños del Carrizal, Aug. 1912, *Purpus* 6230 (G, NY, US, MBG); San Francisco, May, 1894, *C. L. Smith* 1339-1374 (G); Remulatero, April, 1922, *Purpus* 8771 (G, NY, US, MBG).

GUERRERO: Iguala, Aug. 1905, *Rose, Painter & Rose* 9274 (MBG, NY, US); El Correjo, May 18, 1899, *Langlassé* 1029 (US).

OAXACA: Camino de Tonomeca, May 7, 1917, *Conzatti & Reko* 3258 (US, MBG).

CHIAPAS: Petapa, May 29, 1904, *Goldman* 1027 (US).

COSTA RICA: Salinas, July, 1890, *Pittier* 2908 (US); Nicoya, April, 1900, *Tonduz* 13900 (G, NY, US); Liberia, Dept. Guanacaste, April, 1893, *Shannon* 5042 (US); Las Huacas, Nicoya Peninsula, May 24, 1903, *Cook & Doyle* 723 (US).

EL SALVADOR: Sonsonate, Dept. Sonsonate, alt. 220-300 m., March 18-27, 1922, *Standley* 22372 (G, NY, US); Laguna de Olomega, Dept. San Miguel, Feb. 20, 1922, *Standley* 21034 (US); La Cebadilla, Dept. San Salvador 1922, *Calderon* 1230 (US); between San Martin and Laguna de Ilopanga, Dept. San Salvador, April 1, 1922, *Standley* 22539 (US).

NICARAGUA: Momotombo, May 27, 1895, *C. L. Smith* 126 (G, NY); Los Braziles, Jan. 28, 1928, *Mell* 28 (NY); south of Managua, March 3, 1922, *Greenman & Greenman* 5713 (MBG).

GUATEMALA: Fiscal, alt. 3700 ft., May 31, 1909, *Deam* 6070 (G, US); Agua Caliente, March 28, 1922, *Greenman & Greenman* 5920 (MBG); Barranquillo, Dept. El Progreso, May 21, 1920, *Popenoe* 977 (US); between Chiquín and Crapeche Grande, Dept. Guatemala, March 19, 1905, *Pittier* 133 (US); El Rancho, Dept. Jalapa, April 4, 1905, *Maxon & Hay* 3766 (US); Dept. Jalapa, March 10, 1905, *Kellerman* 4511 (US).

ECUADOR: Guayaquil, Feb. 1885, *Rusby* 931 (NY); hillsides near Guayaquil, Sept.-Oct. 1925, *Mille* 59 (NY); Durán, Nov. 5-8, 1918, *Rose & Rose* 23612 (NY).

BOLIVIA: near Yungas, alt. 4000 ft., 1885, *Rusby* 1163 (NY).

Section 2. GALEOTTIAN Woodson. Proper-throat of the corolla cylindrical, much longer than broad.

KEY TO THE SPECIES

- a. Proper-tube about equalling the length of the proper-throat; corolla-tube, *sensu-latiore*, 3-3.5 cm. long.
 - b. Calyx-lobes 1.5-2 mm. long; corolla-limb 5-8 mm. broad. 5. *S. Alfari*
 - bb. Calyx-lobes 5-7 mm. long; corolla-limb 10-15 mm. broad. 6. *S. Greenmanii*
- aa. Proper-tube much surpassed by the length of the proper-throat; corolla-tube, *sensu-latiore*, 4.5-6 cm. long.
 - b. Calyx 1-1.5 cm. long, the lobes distinctly imbricated. 7. *S. Galeottiana*
 - bb. Calyx 4-5 mm. long, the lobes scarcely imbricated. 8. *S. macrophylla*

5. *Stemmadenia Alfari* (Donn.-Sm.) Woodson, n. comb.

Tabernaemontana Alfari Donn.-Sm. Bot. Gaz 24: 396. 1897.

Small tree 3-4 m. tall; leaves 7-11 cm. long, 3.5-5 cm. broad, glabrous, acuminate, subspathulate, petiolate, petioles 1-1.5 cm. long; inflorescence 1-3-flowered; corolla infundibuliform or occasionally subinfundibuliform, yellow or yellowish white, the tube, *sensu-latiore*, 3-3.5 cm. long, the limb 1-1.5 cm. broad; calyx-lobes 1.5-2 mm. long, 1.5-2 mm. broad, scarcely imbricated in two series, both the inner and the outer yellowish; follicles unknown.

Distribution: hedgerows and waste-lands, Costa Rica.

Specimens examined:

COSTA RICA: San Pedro, near San Ramón, hedgerows, alt. 1300 m., April 13, 1913, *Tonduz 17653* (F); Limoncito and Vuelta, alt. 1100 m., March, 1897, *Pittier 11094* (US TYPE).

6. *Stemmadenia Greenmanii* Woodson, n. sp.¹ Pl. 48, fig. 2.

Shrubs or small trees 1-6 m. tall; leaves 8-12 cm. long, 4-5 cm. broad, glabrous, petiolate, petioles 5-8 mm. long; inflorescence 2-5-flowered; corolla yellowish white, the proper-tube about 1.5 cm. long, the proper-throat cylindrical, about 2.0 cm. long, about .8 cm. broad at the orifice, the limb 1-1.5 cm. broad; calyx about one-third the length of the proper-tube, the segments .5-.7 cm. long, .3-.4 cm. broad, strongly imbricated in two unequal series, both series yellowish; immature specimens oblong-lanceolate, acute at the apex.

¹ *Stemmadenia Greenmanii* sp. nov., arborea glabra; foliis oblongo-lanceolatis 8-12 cm. longis 4-5 cm. latis; petiolis 5-8 mm. longis; corollae tubo cylindrico-infundibuliformo 3-5 cm. longo, lobis 1-1.5 cm. longis; lobis calycis ovatis inaequalibus ca. .5 cm. longis 3-4 mm. latis flavis; folliculis oblongo-lanceolatis acutiusculis. —Costa Rica, San Ramon, June 4, 1901, *Brenes 14275* (Gray Herb., TYPE).

Distribution: tropical forests and thickets, Costa Rica.

Specimens examined:

COSTA RICA: San Ramón, alt. 1100 m., May 29, 1901, *Brenes* 14275 (G TYPE); San Ramón, June 4, 1901, *Brenes* 14278 (G).

This species is evidently very local, but is very distinct. The nearest related species is undoubtedly *S. Alfari*, from which, however, it differs radically in the size of the calyx and all the floral parts. The species is dedicated to Dr. J. M. Greenman, by all odds the most discriminating of recent students of the group.

7. *Stemmadenia Galeottiana* (A. Rich.) Miers, Apoc. S. Am. 76. 1878. Pl. 47, figs. 2-3.

Odontostigma Galeottiana A. Rich. in Sagra, Hist. Cub. 11: 868. t. 60 (Fl. Cub. Fanerog. 2: 86). 1853; Walp. Ann. 5: 477. 1858.

Echites bignoniaeflora Schl. Linnaea 26: 372. 1853.

Stemmadenia bignoniaeflora (Schl.) Miers, Apoc. S. Am. 76. 1878; Donn.-Sm. Enum. Pl. Guat. 5: 51. 1899; Standl. Contr. U. S. Nat. Herb. 23: 1156. 1924.

Stemmadenia insignis Miers, Apoc. S. Am. 76. t. 10B. 1878; Hemsl. Biol. Cent.-Am. Bot. 2: 310. 1881; Standl. Contr. U. S. Nat. Herb. 23: 1156. 1924.

Tabernaemontana laurifolia Schott (non L., nec Ker, neque Blanco) ex Miers, Apoc. S. Am. 76. 1878 *nomen*.

Stemmadenia bella Miers, Apoc. S. Am. 77. 1878; Donn.-Sm. Enum. Pl. Guat. 5: 51. 1899; Standl. Contr. U. S. Nat. Herb. 23: 1156. 1924.

Stemmaderia Galeottianum B. D. Jackson, Ind. Kew. 2: 331. 1844, err. typ.

Shrubs, 1-3 m. tall; leaves 9-12 cm. long, 4-5 cm. broad, glabrous or slightly puberulent upon the lower surface, petiole, petioles 8-11 mm. long; inflorescence 1-4-flowered; corolla yellow, the proper-throat 4-5 cm. long, 1.0-1.3 cm. broad at the orifice, the proper-tube 8-10 mm. long, the limb 2.5-3 cm. long; calyx segments 10-14 mm. long, 4-7 mm. broad, strongly imbricated in two unequal series; follicles 2-2.5 cm. long, 1.5-1.7 cm. broad.

Distribution: tropical forests of southern Mexico and Costa Rica.

Specimens examined:

MEXICO:

VERA CRUZ: Teocelo, May 8, 1901, *Goldman 575* (US); Zacuapan, March, 1917, *Purpus 7740* (G, NY, US, MBG); Orizaba, March 23, 1867, *Bilimek 269* (G); Orizaba, date lacking, *Botteri 988* (G); Textolo, alt. 3500 ft., April 26, 1899, *Pringle 8103* (G, NY, ANSP, US, F, MBG); Orizaba, April, 1866, *Bourgeau 2440* (G, US).

OAXACA: exact locality lacking, 1841, *Galeotti 1605* (NY co-type?); Sontecomopan, *Galeotti 1599* (US).

YUCATAN: Merida, April 14, 1887, *Millsaugh 27* (F); Izamal, cultivated for its flowers, date lacking, *Gaumer 23204* (F); Merida, Quinta del Obispo, March 18, 1865, *Schott 430* (US, F).

Since *Odontostigma Galeottiana* A. Rich. and *Echites bignoniæflora* Schl. were both published in 1853 at unknown months, according to the fly-leaves of the journals in which they appeared, it was perplexing whether to conserve *Stemmadenia Galeottiana* or *S. bignoniæflora*. However, on the fly-leaf of Asa Gray's copy of 'Linnaea' 26, in which *E. bignoniæflora* was published, appears the note in Dr. Gray's handwriting that the publication did not actually leave the press until August, 1854. In the absence of contradiction, then, it is assumed that Richard's species appeared in 1853, and is therefore considered to have priority.

8. *Stemmadenia macrophylla* Greenm. Proc. Am. Acad. 35: 310. 1900; Donn.-Sm. Enum. Pl. Guat. 6: 83. 1903.

Shrubs or small trees; leaves 15-20 cm. long, 5-7 cm. broad, glabrous, petiolate, petioles 1.5-2 cm. long; inflorescence 1-4 flowered; corolla yellow, the proper-throat cylindrical, 2.5-3 cm. long, .8-1.2 cm. broad, the proper-tube 1.5-2 cm. long, the limb 2.5-3 cm. broad; calyx about one-half the length of the proper-tube, the segments 4-6 mm. long, 3-4 mm. broad, scarcely imbricated in two unequal series, both series yellowish; follicles unknown.

Distribution: tropical thickets of Guatemala.

Specimens examined:

GUATEMALA: Pansamá, Dept. Alta Verapaz, alt. 3800 ft., Jan. 1886, *Tuerckheim* 981 (G TYPE, NY, US, MBG); Coban, Dept. Alta Verapaz, April, 1889, *Donnell-Smith* 1800 (US); San Carlos Miramar, March 19, 1921, 750 m., *Tonduz & Rojas* 147 (MBG).

SUBGENUS II. OCHRODAPHNE Woodson

Subgenus I. OCHRODAPHNE Woodson, n. subgen.

Corolla salverform, the lobes dextrorsely reflexed and strongly auriculate; calyx-squamellae in two or three series of nearly uniform length; sporangia of the anthers nearly parallel to the base; rim of the coalesced nectaries nearly smooth; corollar appendages relatively short, 5–7 mm. long; bracts placed midway upon the pedicels. Name coined from *ὄχρος*, yellow, and *δάφνη*, laurel, from the popular name of *Stemmadenia grandiflora* (Jacq.) Miers, "Yellow Laurel."

KEY TO THE SPECIES

- a. Calyx less than one-half the length of the corolla-tube.
 - b. Calyx scarious; leaves ovate to ovate-oblong.
 - c. Inner series of calyx-lobes only slightly longer than the outer; leaves glabrous throughout, glaucous beneath.
 - d. Inflorescence several- or many-flowered; corolla-limb as broad as the length of the tube.
 - e. Calyx-lobes 4–6 mm. long, yellowish, appressed; leaves ovate.....9. *decipiens*
 - ee. Calyx-lobes 10–15 mm. long, green, spreading; leaves ovate-oblong.....10. *S. grandiflora*
 - dd. Inflorescence 1-flowered by abortion; corolla-limb about one-half as broad as the length of the tube.....11. *S. pauciflora*
 - cc. Inner series of calyx-lobes about twice as long as the outer; leaves finely rufose-puberulent beneath.....12. *S. Pennellii*
 - bb. Bracts foliaceous; leaves lanceolate.....13. *S. eubractea*
- aa. Calyx equalling or nearly equalling the length of the corolla-tube.
 - b. Calyx-lobes linear-lanceolate; leaves oblong-lanceolate, glabrous throughout.....14. *S. Robinsonii*
 - bb. Calyx-lobes ovate; leaves spatulate, glabrous above, the under-surface conspicuously barbate in the axils of the midvein.15. *S. Donnell-Smithii*

9. *Stemmadenia decipiens* Woodson, n. sp.¹

¹ *Stemmadenia decipiens* sp. nov., arborea glabra; foliis ovatis 7–10 cm. longis 4–7 cm. latis, petiolis 5–7 mm. longis; corollae tubo salverformo 2–3 cm. longo, lobis 1–2 cm. longis; lobis calycis ovatis inaequalibus 4–6 mm. longis 2–3 mm. latis flavis; folliculis ovato-oblongis acutibusque.—Mexico, between Rosario and Colomas, Sinaloa, July 12, 1897, *J. N. Rose* 1614 (US. TYPE).

Shrubs or small trees, 2-10 m. high; leaves 7-10 cm. long, 4-7 cm. broad, glabrous, petiolate, petioles 5-7 mm. long; inflorescence 3-9-flowered; corolla yellow or yellowish white, the tube 2-3 cm. long, 4-5 mm. broad at the orifice, the limb 1-2 cm. broad; calyx about one-fifth the length of the tube, the segments 4-6 mm. long, 2-3 mm. broad, slightly imbricated in two unequal series, both series yellowish, appressed; immature follicles ovate, attenuate at the apex, mature follicles unknown.

Distribution: southern Mexico and adjacent Central America.

Specimens examined:

MEXICO:

SINALOA: between Rosario and Colomas, July 12, 1897, *Rose* 1614 (US, No. 300461 TYPE, 300462); near Rosario, July 24, 1897, *Rose* (US).

OAXACA: Pochutla, April 19, 1917, *Conzatti, Reko & Makrinius* 3172 (MBG).

NICARAGUA: Managua, 1925, *René* 78 (MBG).

This species has been called *decipiens* because it possesses the smallest calyx of the subgenus *Ochrodaphne*, thus recalling the small calyx-lobes of *S. Palmeri* in the subgenus *Eustemma*, for which it has been mistaken.

10. *Stemmadenia grandiflora* (Jacq.) Miers, Apoc. S. Am. 75. 1878. Pl. 47, fig. 4.

Tabernaemontana grandiflora Jacq. Enum. Pl. Carib. 14. 1762; L. Mant. 53. 1767; Willd. Sp. Pl. 1³: 1245. 1798; Lam. Diet. 7: 528. 1806; Roem. & Schult. Syst. 4: 428. 1819; A. DC. in DC. Prodr. 8: 368. 1844; G. Don, Gen. Syst. 4: 88. 1887; Sesse & Mocino, Fl. Mex. 431. 1894; Ramirez, Pl. Mex. 155. 1902; Pulle, Enum. Vasc. Pl. Sur. 381. 1906; Standl. Contr. U. S. Nat. Herb. 27: 308. 1928.

Shrubs or small trees; leaves 6-8 cm. long, 3-5 cm. broad, glabrous, petiolate, petioles 5-7 mm. long; inflorescence 2-9-flowered; corolla yellowish white, the tube 3-3.5 cm. long, 4-5 mm. broad at the orifice, the limb 1.5-2 cm. broad; calyx about one-third the length of the tube, the segments 8-12 mm. broad, 10-15 mm. long, closely imbricated in two unequal series, both

series green, spreading; follicles 3–3.5 cm. long, 2–3 cm. broad, acute at the apex.

Distribution: tropical forests, southern Mexico, Central America, and northeastern South America.

Specimens examined:

MEXICO:

SINALOA: Colomas, July 16, 1897, *Rose 1711* (US); near Colomas, July 14–17, *Rose* (US).

NAYARIT: vicinity of Acaponeta, Tepic, April 12, 1910, *Rose, Standley & Russell 14484* (US).

COSTA RICA: exact locality and date lacking, *Tonduz 17653* (US).

PANAMA: Chagres, Jan.–March, 1850, *Fendler 234* (G, MBG); exact locality and date lacking, *Duchassaing* (G); Puerto Remedios, Chiriqui, March 31, 1911, *Pittier 3388* (NY, US); Fato, Dept. Colon, along the beach, July 8–10, 1911, *Pittier 3940* (US); David, Chiriqui, Feb. 25, 1911, *Pittier 2824* (US); Cana, April 17, June 8, 1908, *Williams 803* (US); Cerro Gordo, near Culebra, June 29, 1911, *Pittier 3739* (US); Paso del Olá, Prov. Coclé, Dec. 7–9, 1911, *Pittier 5011* (US); Mount Hope Cemetery, Canal Zone, Dec. 28, 1923, *Standley 28840* (US); Punta Paitilla, Nov. 3, 1921, *Heriberto 209* (US); Puerto Obaldia, forests, Oct. 11, 1911, *Pittier 4406* (US); Sabana de Juan Corso, Prov. Panama, near Chepo, Sept. 1911, *Pittier 4748* (US); Panama City, old Experiment Station, June 13, 1923, *Maxon, Harvey & Valentine 7084* (US); Bella Vista, near Panama City, June 12, 1923, *Maxon & Valentine 6948* (US); Juan Diaz, Prov. Panama, near Tapia River, June 1–3, 1923, *Maxon & Harvey 6751 & 6646* (US); Corozal, Canal Zone, Aug. 1924, *Stevens 90* (US); Chivi-Chivi Trail, 2 mi. above Red Tank, Canal Zone, May 28, 1923, *Maxon & Harvey 6599* (US); Barro Colorado Is., Canal Zone, Aug. 18, 1927, *Kenoyer 500* (US); Changuinola Valley, 1927, *Cooper & Slater 63a* (US); Taboga Is., Feb. 26, 1923, *Macbride 2798 & 2799* (US); Barro Colorado Is., Canal Zone, Nov. 18–24, 1925, *Standley 40994* (US).

VENEZUELA: Tovar Colony, Aug. 16, 1855, *Fendler 1027* (G, NY); San Martin, on the Rio de Palomar, Oct. 15, 1922, *Pittier 10516* (G); between La Guaira and Rio Grande, June 12, 1917,

Curran & Haman 971 (G, US); San José & Rio Chico, June 16, 1913, *Pittier 6355* (NY); Cierucunté, April 10, 1922, *Pittier 10288* (NY); La Guavia, July 4, 1900, *Robinson & Lyon* (US); Puerto La Cruz, April, 1914, *Jahn 336* (US); Rio Chico, Miranda, June 20, 1923, *Jahn 1280* (US); between San José and Las Trincheras, Fed. Dist. (Caracas), Oct. 4, 1921, *Pittier 11* (US); Curucuti, March 19, 1918, *Pittier 7774* (US); Perijá, Zulía, 1917, *Tejera 14* (US).

COLOMBIA: Turbaco, Nov. 1920, *Heriberto 461* (US); Cartagena, 1919, *Heriberto 249* (US); between Ciénaga de Santa Marta and the foothills, June 22-30, 1906, *Pittier 1594* (US, NY); San Martin de Loba and vicinity, Bolívar, April-May, 1916, *Curran 12* (US); Santa Marta, 1898-1901, *H. H. Smith 1639* (MBG, NY, ANSP, US).

DUTCH GUIANA: Paramaribo, on way to Kwatta, *Samuels* (US); Paramaribo, forests on the way to the farm of Kwatta, April 27, 1916, *Samuels 384* (G); Paramaribo, forest behind Gongrypstreet, April 12, 1916, *Samuels 385* (G); Paramaribo, May 10, 1905, *Mayo* (ANSP); "Surinam," *Weigelt* (ANSP).

This common species is known popularly in Panama as "Huevo de Gato," "Lechosa," and "Venenillo"; in Venezuela as "Hueves de Burro"; and in Mexico as "Lechoso." Called "yellow laurel" by G. Don.

11. *Stemmadenia pauciflora* Woodson, n. sp.¹ Pl. 49, fig. 1.

Shrubs or small trees; leaves 8-12 cm. long, 2.5-5 cm. broad, glabrous, petiolate, petioles 2-3 mm. long; inflorescence 1-flowered by abortion; corolla yellow or yellowish white, salverform, the tube 3-4 cm. long, 3-4 mm. broad at the orifice, the limb 1-1.5 cm. broad; calyx about one-fourth the length of the tube, the segments 7-9 mm. long, 6-9 mm. broad, strongly imbricated in two unequal series, both series green; follicles unknown.

Distribution: north-central Colombia and Guiana.

¹ *Stemmadenia pauciflora* sp. nov., arborea glabra; foliis oblongo-lanceolatis 8-12 cm. longis 2.5-5 cm. latis, petiolis 2-3 mm. longis; cymis unifloris abortivis; corollae tubo salverformo 3-4 cm. longo, lobis 1-1.5 cm. longis; lobis calycis ovatis inaequalibus 7-9 mm. longis 6-9 mm. latis viridis; folliculis ignotis.—Colombia, between Espinal and Cuamo, Tolima, open loam along stream, alt. 350-400 m., July 21, 1917, *Pennell & Rusby 186* (NY TYPE).

Specimens examined:

COLOMBIA: open loam along stream, between Espinal and Cuamo, alt. 350–400 m., Tolima, July 21, 1917, *Pennell & Rusby 186* (NY TYPE).

DUTCH GUIANA: "in sylvis pr. urbem Paramaribo," March–April, 1844, *Kappler 1565* (MBG).

Stemmadenia pauciflora, so-called because of the singularly reduced inflorescence, is equally distinct because of the short corolla-limb. At present the two specimens referable to the species constitute a rather scattering range, but doubtless with increased collecting activity additional localities will become known. The young inflorescence is normally composed of several buds, all of which abort very early except the one destined to produce the fully-developed flower. This character of the inflorescence is demonstrated nicely by the two above-cited specimens. Upon *Kappler 1565* three inflorescences appear, one with one aborting and one developing bud, and two with full-blown flowers and one aborted bud each. *Pennell & Rusby 186* likewise demonstrate this remarkable propensity. On that sheet (NY) three inflorescences appear, one with one aborting and one developing bud, another with two aborted and one developing bud, and another with a full-blown flower and one aborted bud.

12. *Stemmadenia Pennellii* Woodson, n. sp.¹

Shrubby vines (?) or shrubs; leaves 7–9 cm. long, 3–4 cm. broad, glabrous or glabrate above, beneath softly rufous-puberulent, petiolate, petioles 1–3 mm. long; inflorescence 2–4-flowered; corolla salverform, yellow, the tube 3–3.5 cm. long, the limb 2.5–3 cm. broad; calyx-lobes in two very unequal series, the inner about 2 cm. long, the outer 1.2–1.5 cm. long, 7–10 mm. broad, strongly imbricated; follicles unknown.

¹ *Stemmadenia Pennellii* sp. nov., arborea vel vinea frutescens (?), foliis oblongo-lanceolatis 7–9 cm. longis 3–4 cm. latis supra glabris vel glabratibus subtus rufo-puberulentis; petiolis 1–3 mm. longis; corollae tubo salverformo 3–3.5 cm. longo, lobis ca. 2.5 cm. longis; lobis calycis majusculis inaequalibus 2-serialibus, inferioris ca. 2 cm. longis superioris 1.2–1.5 cm. longis, virido-flavibus; folliculis ignotis.—Colombia, Turbaco, Bolivar. Shrubby vine, thin loam over white rock, alt. 150–200 m., March 27, 1918, *Pennell 4755* (Gray Herb. TYPE).

Distribution: southern Mexico and northern Colombia.

Specimens examined:

MEXICO:

GUERRERO: Achatla, May, 1926, *Reko 4892* (US).

COLOMBIA: Turbaco, Bolivar. Shrubby vine. Thin loam over white rock, alt. 150–200 m., March 27, 1918, *Pennell 4755* (G TYPE, US, F, MBG).

This species, although closely related to *S. grandiflora*, is very distinctive, not only because of the strikingly unequal calyx-lobes, but because of the rufous puberulence of the leaves. The flowers, also, appear to be more turbinate in the reflexion of the corolla-lobes than any other species of *Ochrodaphne*, but this character has not been noted because most of the specimens of that subgenus are so poorly pressed, and Dr. Pennell's are so carefully prepared, that use of this character would be dangerous. The species is dedicated to Dr. Francis W. Pennell, of the Academy of Natural Sciences of Philadelphia, the collector of the type specimen.

13. *Stemmadenia eubracteata* Woodson, n. sp.¹ Pl. 49, fig. 2.

Shrubs or small trees; leaves 6–8 cm. long, 2–3 cm. broad, glabrous, petiolate, the petioles 4–5 mm. long; inflorescence 2–5-flowered; corolla salverform, yellow, the tube about 2.5 cm. long, the limb about 1.5 cm. broad; calyx-lobes 3–4 mm. broad, 8–10 mm. long, all green, spreading; bracts semifoliateous; follicles unknown.

Distribution: known only from the type locality in Guatemala.

Specimens examined:

GUATEMALA: Volcan Tecuamburro, Dept. Santa Rosa, alt. 2000 m., Feb. 1893, *Heyde & Lux 4538* (G TYPE).

This species is one of the most remarkable species of *Ochrodaphne* by reason of the spreading calyx, the narrow leaves, and above all the curiously foliateous bracts, which are absolutely different from those of any other species of the genus *Stemmadenia*.

¹ *Stemmadenia eubracteata* sp. nov., arborea; foliis lanceolatis 6–8 cm. longis 2–3 cm. latis glabris, petiolis 4–5 mm. longis; corollae tubo salverformo 2.5 cm. longo, lobis ca. 1.5 cm. longis; lobis calycis 3–4 mm. latis 8–10 mm. longis; bracteis semifoliateis; folliculis ignotis.—Guatemala, Volcan Tecuamburro, Dept. Santa Rosa, alt. 2000 m., Feb., 1893, *Heyde & Lux 4538* (Gray Herb. TYPE).

14. *Stemmadenia Robinsonii* Woodson, n. sp.¹

Shrubs or small trees; leaves 12–16 cm. long, 4–5 cm. broad, glabrous, petiolate, the petioles 1–3 mm. long; inflorescence 2–3-flowered; corolla salverform, yellow, the tube 2–2.5 cm. long, the limb about 1–1.5 cm. broad; calyx-lobes linear-lanceolate, 1.5–2 cm. long, 3–4 mm. broad, very slightly imbricated in two unequal series, both series yellow, appressed; follicles unknown.

Distribution: known only from the type locality in Costa Rica.

Specimens examined:

COSTA RICA: Talamanca Mts., March, 1894, *Pittier 8617* (US TYPE).

This species is dedicated to Dr. B. L. Robinson, who, in 1899, questioned its determination as *S. bella* Miers, and called attention in a note upon the specimen to the peculiar calyx, which is the most striking characteristic of the species. In addition to the calyx, *S. Robinsonii* differs from its nearest relative, *S. Donnell-Smithii*, in the leaves, which are glabrous and oblong-lanceolate in the former, and spatulate and barbate in the latter.

15. *Stemmadenia Donnell-Smithii* (Rose) Woodson, n. comb.

Tabernaemontana Donnell-Smithii Rose, Bot. Gaz. 18: 206. 1893.

Tabernaemontana Donnell-Smithii Rose var. *costaricensis* Donn.-Sm. Bot. Gaz. 24: 397. 1897.

Shrubs or small trees; leaves 6–8 cm. long, 3–3.5 cm. broad, spatulate, minutely glandular-puberulent or glabrate above, beneath conspicuously barbate in the axils of the midvein, petiolate, the petioles 1–2 mm. long; inflorescence 1–4-flowered; corolla yellow, salverform, the tube 2.5–3 cm. long, the limb 1.5–2 cm. long; calyx nearly equalling the length of the corolla-tube, 2–2.5 cm. long, the lobes 1.5–2 cm. broad, in two closely imbricated yellowish series; follicles about 3.5 cm. long, about 3 cm. broad, rounded at the apex.

¹ *Stemmadenia Robinsonii* sp. nov., arborea glabra; foliis oblongo-lanceolatis 12–16 cm. longis 4–5 cm. latis, petiolis 1–3 mm. longis; corollae tubo salverformo 2–2.5 cm. longo, lobis 1–1.5 cm. longis; lobis calycis linearo-lanceolatis 1.5–2 cm. longis 3–4 mm. latis; folliculis ignotis.—Costa Rica, Talamanca Mts., March, 1894, *Pittier 8617* (US TYPE).

Distribution: tropical forests, southern Mexico and Central America.

Specimens examined:

MEXICO: locality and date lacking, *Gregg 893* (MBG).

GUERRERO: La Correa, Oct. 5, 1898, *Langlassé 427* (G, US).

COSTA RICA: Nicoya, April, 1900, *Tonduz 13904* (G, NY); Santa Clara, Sept. 1896, *Cooper 10241* (US); Matambú, Nicoya Peninsula, May 23, 1903, *Cook & Doyle 706* (US); Nicoya, alt. 200 m., May 22, 1903, *Cook & Doyle 686* (US); Nicoya, forests, *Tonduz 13904* (US); Capulín, on the Rio Grande de Taracales, Prov. Alojuela, April 2, 1924, *Standley 40220* (US); Arenal, May 5, 1922, *Valerio 86* (US).

BRITISH HONDURAS: Middlesex, Jan. 17, 1926, *Ricard 13* (US).

HONDURAS: Ceiba, Aug. 20, 1916, *Dyer A84* (US).

NICARAGUA: Las Nubes, June 28, 1923, *Maxon, Harvey & Valentine 7502* (US).

GUATEMALA: St. Thomas, May 29, 1909, *Deam 6052* (G); Escuintla, alt. 1100 ft., March, 1890, *Donnell-Smith 2404* (G); San Felipe, Dept. Retalhulen, alt. 2050 ft., April, 1892, *Donnell-Smith 2763* (G, US TYPE, NY, F, MBG); Barranca de Eminencia, Dept. Amatitlan, alt. 1400 ft., Feb. 1892, *Donnell-Smith 2762* (G, NY, MBG); Escoba, June 2, 1922, *Standley 2462* (US); Hacienda el Baul, Dept. Escuintla, March 2, 1921, *Tonduz & Rojas 36* (US); Santa Lucia, Escuintla, March 2, 1905, *Kellerman 5286 & 5275* (US); Mazatenango, border of forest, Feb. 19, 1905, *Maxon & Hay 3490* (US); San Jose de Escuintla, April, 1892, *Donnell-Smith 2765* (US); San Juan Mixtan, April, 1890, *Donnell-Smith 2405* (US); Primavera, Dept. Sololá, Oct. 1891, *Shannon 120* (US); Rio Toro Amarillo, Llanuras de Santa Clara, April, 1896, *Donnell-Smith 6646* (US TYPE var. *costaricensis*); Santa Barbara, Dept. Sololá, Aug. 1891, *Shannon 152* (US); Naranjo, Dept. Escuintla, March, 1892, *Donnell-Smith 2764* (US).

EL SALVADOR: vicinity of San Salvador, alt. 650-850 m., Dec. 20, 1921-Jan. 4, 1922, *Standley 19187* (US, G, NY); vicinity of Izalco, Dept. Sonsonate, March 19-24, 1922, *Standley 21865* (G, US); same locality and date, *Standley 22218* (G, NY, US); vicinity of Ixtepeque, Dept. San Vicente, alt. 400 m.,

March 6, 1922, *Standley 21463* (G, US); San Salvador, 1921, *Calderon 187* (NY, US); San Salvador, 1900, *Renson 106* (US); Armenia, Dept. Sonsonate, April 18, 1922, *Standley 23452* (US); Dept. Ahuachapán, 1923, *Padilla 331* (US); Izalco, Dept. Sonsonate, Feb. 17, 1907, *Pittier 1936* (US).

In referring this species to the genus *Tabernaemontana*, Dr. Rose¹ was fully cognizant of its affinities, and especially of its relation to *Stemmadenia grandiflora*, but preferred to assign it to the former genus, remarking "*T. grandiflora*, as is known, was referred by Miers to *Stemmadenia*, but is retained by Mr. Hemsley in *Tabernaemontana*. The difference between these two genera is sometimes a little difficult to determine." Dr. Rose further added an interesting note concerning the species: "Capt. Smith observes of this plant: 'It is not exactly a tree in habit. It occurred everywhere as I went from the coast up to the slopes of the volcanoes at an elevation of 5,000 ft. The natives call it *Cobal* (varnish gum).' Other popular names for the species are 'Cojón' and 'Cojón de puerco.'"

The observations of Dr. Rose quoted above are representative of the attitude with which the majority of botanists have regarded the genus *Stemmadenia*. This paper will be successful if merely it demonstrates the numerous precise differences between the genera *Tabernaemontana* and *Stemmadenia*.

EXCLUDED SPECIES

Stemmadenia guatemalensis Müll.-Arg. *Linnaea* 30: 410. 1859.
= *Malouetia guatemalensis* (Müll.-Arg.) Standl. Jour. Wash. Acad. Sci. 15: 459. 1925. (*Malouetia panamensis* Müll.-Arg. in Van Heurck, Pl. Nov. 185. 1871.)

LIST OF EXSICCATAE CITED

The distribution numbers are printed in *italics*; collections distributed without numbers are indicated by a dash. The numbers in parentheses indicate the species numbers in the present revision.

Baker, C. F. 2270 (4).

Bilimek, —, 269 (7).

Botteri, M. 988 (7).

Bourgeau, M. 2440 (7).

Brenes, A. M. 14275, 14278 (6).

Calderón, S. 1230 (4); 187 (15).

Chaves, D. 215 (4).

Conzatti, C. & Reko, B. P. 3258 (4a).

Conzatti, C., Reko, B. P. & Makrinus, M. 3172 (9).

Cook, O. F. & Doyle, C. B. 723 (4a); 120, 152, 706, 686 (15).

¹ Rose, Bot. Gaz. 18: 206. 1893.

- Cooper, G. P. 10241 (15).
 Cooper, G. P. & Slater, G. M. 63a (10).
 Curran, H. M. 12 (10).
 Curran, H. M. & Haman, S. 971 (10).
 Deam, C. 6070 (4a); 6052 (15).
 Donnell-Smith, J. 1800 (7); 2404, 2405, 2762, 2763, 2764, 2765, 6646 (15).
 Duchassaing, E. P. —, (10).
 Dyer, F. J. A84 (15).
 Fendler, A. 1027 (10).
 Galeotti, H. 1599, 1605 (7).
 Gaumer, G. F. 23204 (7).
 Goldman, E. A. 358 (1a); 1027 (4a); 575 (7).
 Gregg, J. 893 (15).
 Greenman, J. M. & Greenman, M. T. 5713, 5920 (4a).
 Hartmann, C. V. 534, 1032 (1a).
 Hayes, S. — (3).
 Heilprin, A. & Baker, C. F. — (1).
 Heriberto, Bro. 209, 461, 249 (10).
 Heyde, E. T. & Lux, —, 4538 (13).
 Jahn, A. 336, 1280 (10).
 Jones, M. E. 335 (1a).
 Kappler, A. 1665 (11).
 Kellerman, W. A. 4511 (4a); 5286, 5275 (15).
 Kenoyer, L. A. 500 (10).
 Lamb, F. H. 467 (2).
 Langlassé, E. 1029 (4); 427 (15).
 Macbride, J. F. 2798, 2799 (10).
 Maxon, W. R. 7647, 7727 (3).
 Maxon, W. R. & Harvey, A. D. 6599, 6646, 6751 (10).
 Maxon, W. R., Harvey, A. D. & Valentine, A. T. 7270, 7539 (3); 7542 (4); 6948, 7084, 7502 (10).
 Maxon, W. R. & Hay, R. 3766 (4a); 3490 (15).
 Maxon, W. R. & Valentine, A. T. 6948 (10).
 Mell, C. D. 23 (4a).
 Mexia, Y. 733, 1490 (1a).
 Mille, L. 59 (4a).
 Millsaugh, C. F. 27 (7).
 Montes, M. N. & Salazar, A. E. 405, 268 (1a).
 Ortega, J. G. 4175 (1a).
 Padilla, S. A. 331 (15).
 Palmer, E. M. (1a); 132, 1470 (1a).
 Pennell, F. W. 4755 (12).
 Pennell, F. W. & Rusby, H. H. 186 (11).
 Pittier, H. 1177 (4); 133, 2908 (4a); 11094 (5); 11, 1594, 2824, 3388, 3739, 3940, 4406, 4748, 5011, 6355, 7774, 10288, 10516 (10); 8617 (14); 1936 (15).
 Popenoe, W. 977 (4a).
 Pringle, C. G. 4370 (1); 5151, 5363, 6847, 6872 (1a); 8103 (7).
 Purpus, C. A. 6230, 8771 (4a); 7740 (7).
 Reko, B. P. 4892 (12).
 René, A. 78 (9).
 Renson, C. 106 (15).
 Ricard, B. H. 13 (15).
 Robinson, A. & Lyon, M. W., Jr. — (10).
 Rose, J. N. 1573, 1688, 2888, 3260 (1a); —, 1614 (9); —, 1711 (10).
 Rose, J. N. & Hough, W. 4777 (1a).
 Rose, J. N., Painter, J. H. & Rose, J. S. 9274 (4a).
 Rose, J. N. & Rose, G. 23612 (4a).
 Rose, J. N., Standley, P. C. & Russell, P. G. 13874 (1); 14064, 14544, 14875 (1a); 14484 (10).
 Rusby, H. H. 931, 1163 (4a).
 Samuels, J. A. —, 384, 385 (10).
 Schott, A. 430 (7).
 Seler, C. 3436 (1a).
 Shannon, W. C. 5042 (4a); 120, 152 (15).
 Smith, C. L. —, (3); 126, 1339, 1374 (4a).
 Smith, H. H. 1639 (10).
 Standley, P. C. 20686, 20713, 20943, 32793, 35459 (3); 21034 (4); 22372, 22539 (4a); 22840, 40994 (10); 19187, 21463, 21866, 22218, 23452, 2462, 40220, 40994 (15).
 Stevens, F. L. 90 (10).
 Tejera, E. 14 (10).
 Tonduz, A. 13900 (4a); 17653 (5); 13904 (15).
 Tonduz, A. & Rojas, A. 147 (7); 17653 (10); 36 (15).
 Tuerckheim, H. von. 981 (7).
 Valerio, J. 86 (15).
 Weigelt, C. — (10).
 Williams, R. S. 803 (10).

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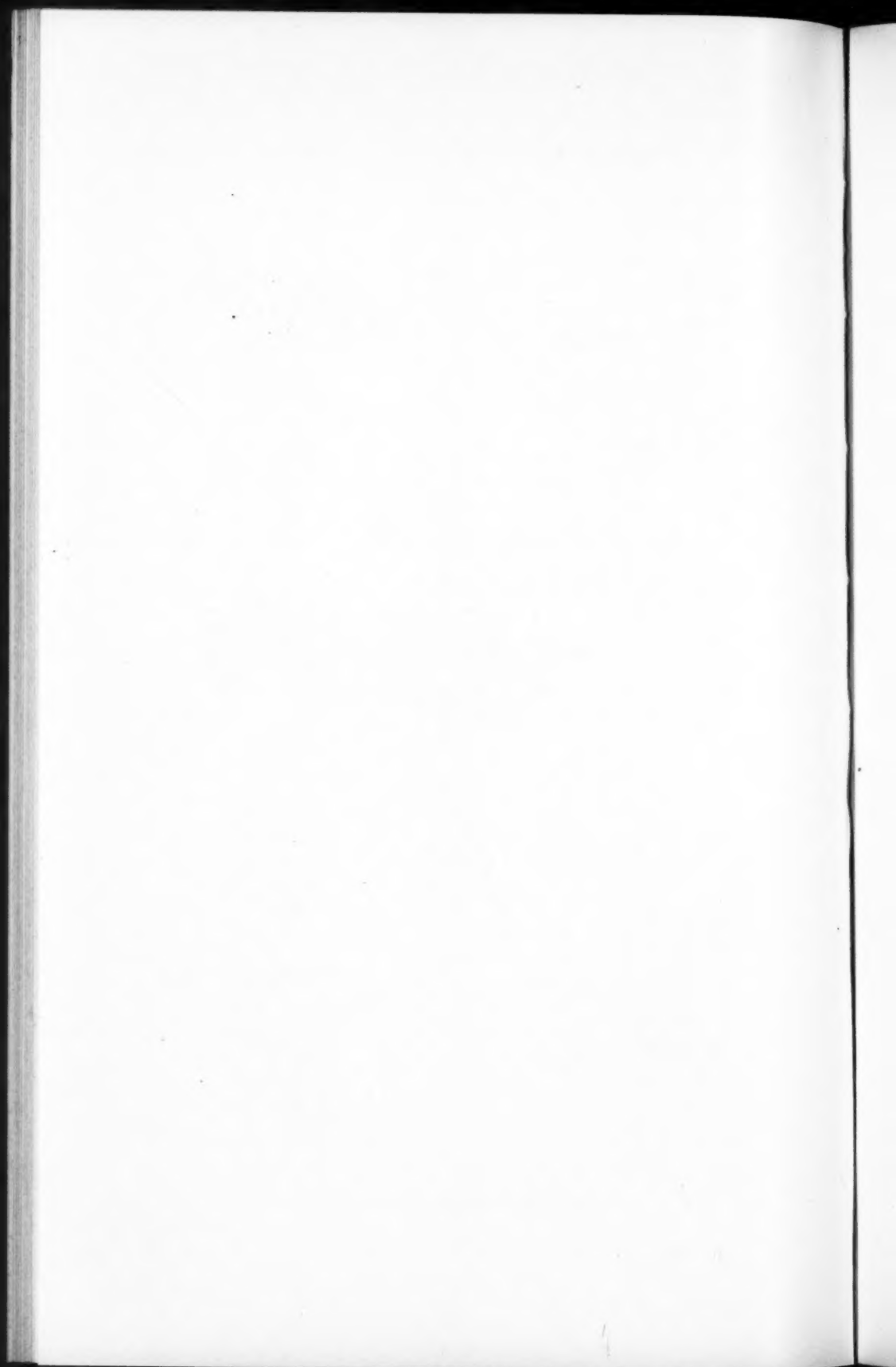
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PLATE 47

- Fig. 1. Habit of *Stemmadenia glabra*. $\times \frac{1}{2}$.
Fig. 2. Habit of *Stemmadenia Galeottiana*. $\times \frac{1}{2}$.
Fig. 3. Detail of floral mechanism of *Stemmadenia Galeottiana*. $\times 2$.
Fig. 4. Habit of *Stemmadenia grandiflora*. $\times \frac{1}{2}$.
Fig. 5. Fruit of *Stemmadenia tomentosa* var. *Palmeri*. $\times \frac{1}{2}$.



WOODSON—STUDIES IN APOCYNACEAE

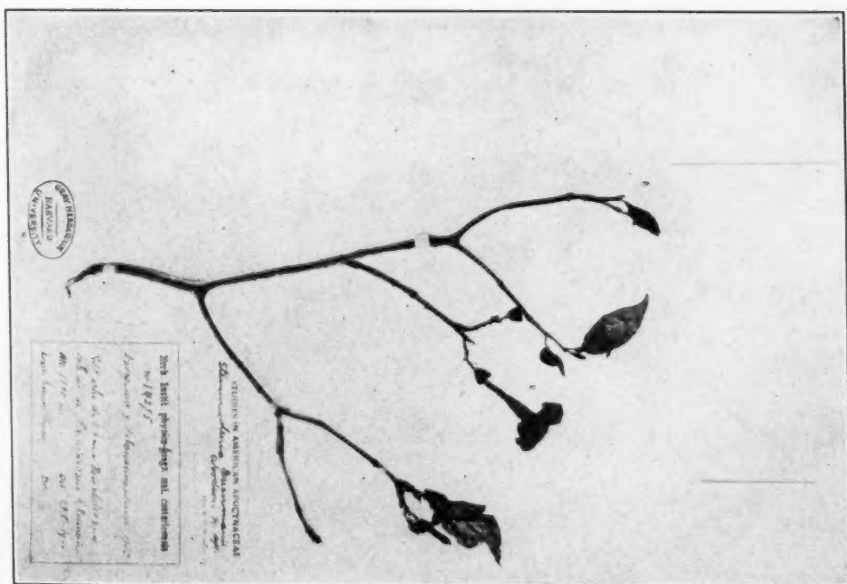
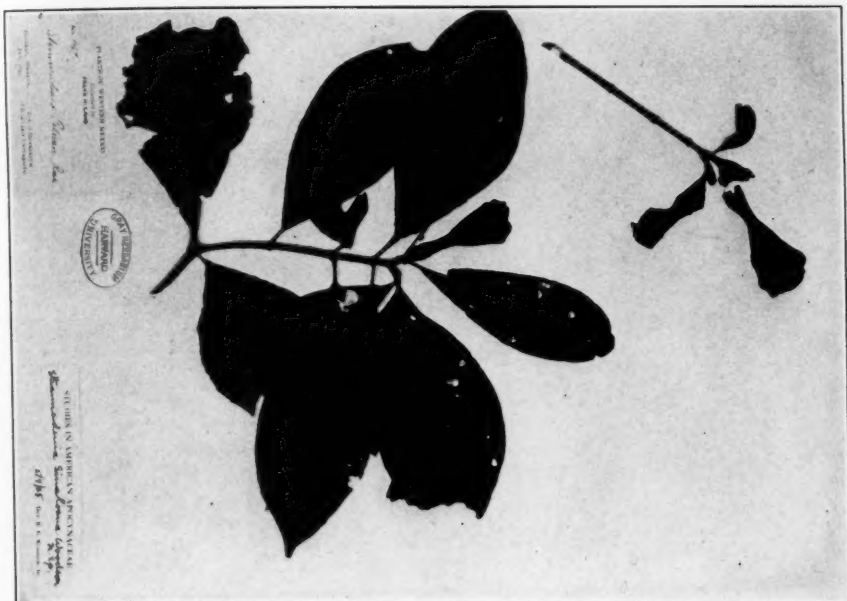


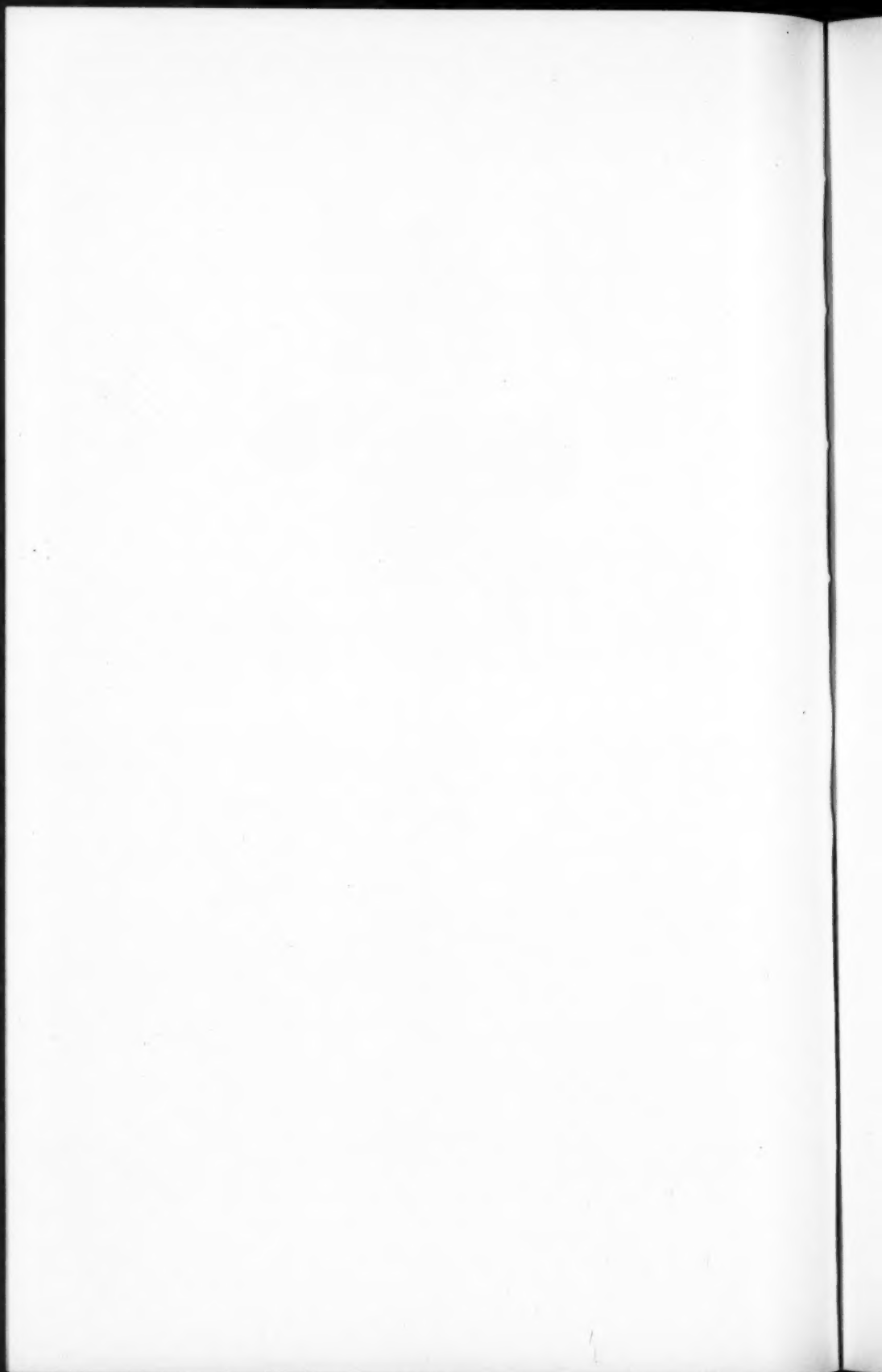
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PLATE 48

Fig. 1. *Stemmadenia sinaloana* Woodson, from the type specimen, *P. H. Lamb* No. 467, in the Gray Herbarium of Harvard University.

Fig. 2. *Stemmadenia Greenmanii* Woodson, from the type specimen, *Brenes* 14275, in the Gray Herbarium of Harvard University.







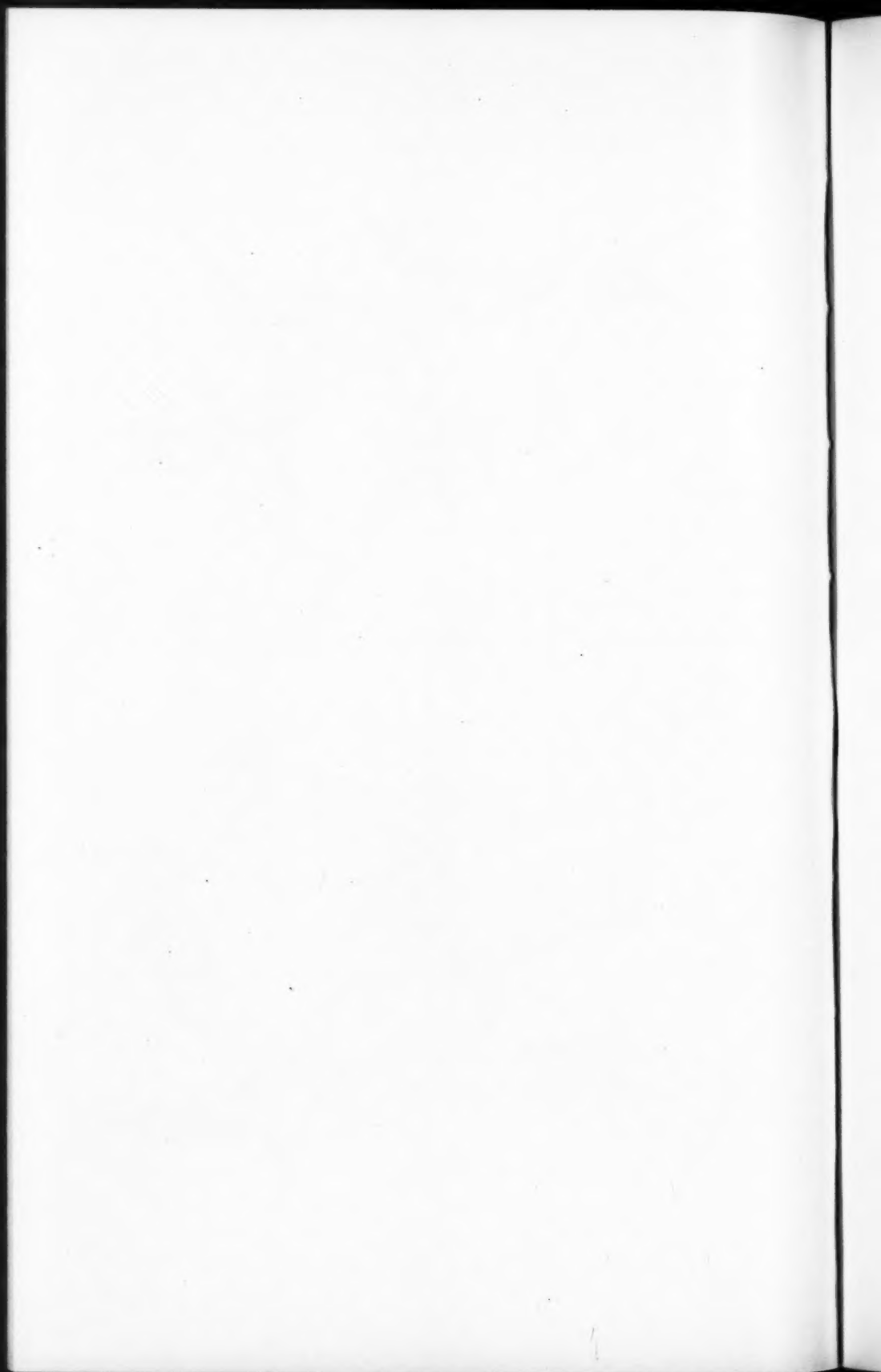
EXPLANATION OF PLATE

PLATE 49

Fig. 1. *Stemmadenia pauciflora* Woodson, from the type specimen, Pennell & Rusby No. 186, in the Herbarium of the New York Botanical Garden.

Fig. 2. *Stemmadenia eubracteata* Woodson, from the type specimen, Heyde & Luz No. 4538, in the Gray Herbarium of Harvard University.





STUDIES IN THE APOCYNACEAE. III

A MONOGRAPH OF THE GENUS AMSONIA

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HISTORICAL DISCUSSION

When the second edition of Linnaeus's 'Species Plantarum' appeared in 1762, one of the many additions to the species presented in the first edition (1753) was *Tabernaemontana Amsonia*,¹ a plant the exact genus of which Linnaeus himself was not precisely sure, qualifying it to the genus *Tabernaemontana* with the remark "Affinis Camerariae et Tabernaemontanae." The attitude with which Linnaeus treated his *Tabernaemontana Amsonia* is essayed by Sir J. E. Smith,² and throws much illumination upon problems concerning the genus which will receive subsequent treatment in this monograph: "*Tabernaemontana* —. The herbaceous plants, supposed by Linnaeus to belong to this genus, constitute, as we have already said, and as Linnaeus himself originally thought, a very distinct one, of which we shall now treat by the name of *Amsonia*. We can give no positive account of the meaning or origin of this word except that its author, according to Miller,³ was Clayton. Linnaeus in his own copy of Gronovius' *Flora Virginica*, ed. 1. p. 26, has written *Amsonia* as a generic name, to what Clayton took for a species of *Nerium*, and has subjoined also in manuscript the characters of the follicles and seeds. This plant, in the second edition of the *Species Plantarum*, is the *T. Amsonia*; and so it remained until Mr. Walter restored it to rank as a genus; but without throwing any light upon the name."

The name *Amsonia* has indeed been an enigma, and Rafin-

¹ L. Sp. Pl. ed. 2, 2: 301. 1762.

² Sm. in Rees, Cycl. 35. 1819.

³ Miller, Gard. Dict. ed. 5, 2^a: art. "*Tabernaemontana*." 1807.

Issued December 22, 1928.

esque¹ even went so far as to change the name to "*Ansonia*," referring to the passage above quoted from Smith, and naively remarking that he had been acquainted with several Ansons, but never an Amson, and so the name must be misspelled.

With the fresh stimulus of Rafinesque's contention a special search was made for the origin of the name *Amsonia*, and for a time it appeared that Rafinesque's intuition had been well guided, for, although all of the published floras and manuals dealing with the genus spoke readily of "Dr. Amson, a colonial physician," or "Charles Amson, a physician of South Carolina," no authentic trace of that gentleman could be found, either in published encyclopedias or standard reference works. Historical societies in Virginia and the Carolinas were invoked to no avail. An Amson, any Amson whatever, was not forthcoming.

However, Ansons were frequent, including a certain Lord George Anson, a royal governor fond of explorative expeditions, from one of which he had discovered and brought to civilization a new esculent pea. Rafinesque was about to be vindicated, when a letter from Clayton to John Bartram appeared which seems to solve the problem, although not completely. The letter, which was written from Gloucester County, Virginia, Sept. 1, 1760, follows:

"Dear Friend:

"I have sent you, enclosed, some seed of a new plant, which I presume is a stranger in your northern part of the world. Indeed it grows here only in the southern parts of the colony. I have it in my garden, but have quite forgotten whether I showed it to you, when I had the favor of your company. If I did, I believe I told you it was to be called *Amsonia*, after a doctor, here; but I think the name inscribed upon the inclosed more proper, as it answers to the particular form of its seed.

"I intend to send you some of the seed of our thorny Sensitive Plant by the first opportunity that offers, after it is ripe;

"And remain, dear sir, your sincere
friend

"And most most humble servant,

"JOHN CLAYTON."

¹ Raf. New Fl. N. Am. 4: 58. 1838.

Allowing for orthographical errors, then, *Amsonia* was definitely named for a certain Dr. Amson, a physician of Gloucester Co., Virginia; but regarding his complete name, or the positive form of spelling of his family name, doubt still remains. Lord Anson, however, can undoubtedly be discarded as a possibility. The "name inscribed upon the inclosed," which Clayton thought to be "more proper," was evidently *Tabernaemontana Amsonia*.

Tabernaemontana Amsonia was immediately conspicuous among the other *Tabernaemontanas* both in habit and in habitat, since it was the only temperate herbaceous member of the genus, and in 1788 attracted the attention of Thomas Walter,¹ who described from it a new genus, naming the type species, in transposition of the Linnaean combination, *Amsonia Tabernaemontana*. At the same time, Walter² also described a new plant from the Carolinas which he assigned to the same new genus, calling it *A. ciliata*.

As a result of his explorations in the southeastern United States, André Michaux³ was able to expand the little genus with the addition, in 1803, of two new species, *A. latifolia* and *A. angustifolia*. The latter was a transfer to *Amsonia* of a species placed in the genus *Tabernaemontana* by Aiton⁴ in 1789. Pursh,⁵ in 1814, also published a new species which he named *A. salicifolia*.

Probably the most interesting addition which has ever been made to the species of *Amsonia* was in 1819, when Roemer and Schultes⁶ transferred to that genus a plant which had been assigned to *Tabernaemontana* by Thunberg⁷ in 1784. The species, *A. elliptica*, was a native of Japan, and is yet the only known member of the genus not native to North America. Thunberg was slightly hesitant, as was Linnaeus, in committing his plant to the genus *Tabernaemontana*, but relied upon the precedence of the earlier author, remarking, much as did Lin-

¹ Walt. Fl. Carol. 98. 1788.

² Walt. l. c. 1788.

³ Michx. Fl. Bor. Am. 1: 121. 1803.

⁴ Ait. Hort. Kew. 1: 300. 1789.

⁵ Pursh, Fl. Am. Sept. ed. 1, 1: 184. 1814.

⁶ Roem. & Schult. Syst. Veg. 4: 432. 1819.

⁷ Thunb. Fl. Jap. 111. 1784.

naeus, "Valde affinis Amsoniae," a significant statement in the light of the later disposition of the species.

The same year there appeared in the Rees 'Cyclopaedia' the description by Sir J. E. Smith¹ of a species of *Amsonia* which he called *A. tristis*. The plant was reported grown in an English garden from seed collected in North America by Lyon, who contributed the plant from which Pursh published his *A. salicifolia*. Smith gave to his plant the common name "brownish-flowered Amsonia," since, as he wrote, "The flowers . . . are of a dingy brown hue, the segments of their limb strongly reflexed, at least in fading." The species has not been reported since its publication, and because of the rather suspicious-sounding description of the flowers, the name has generally been referred to as a synonym of *A. Tabernaemontana* Walt., or of *A. salicifolia* Pursh.

Rafinesque's 'New Flora of North America' appeared in 1838, with a comparative sketch of the "Ansonias" then recognizable, and added one new species, *A. tenuifolia*,² the originality of which the author took unusual pains to indicate.

In the 'Prodromus' of De Candolle the genus *Amsonia* received its first collective treatment. Besides recognizing the species which had previously been published with the exception of *A. tenuifolia* Raf., Alphonse De Candolle³ described a new plant which he termed *A. salicifolia* Pursh var. *ciliolata*, from Alabama and Louisiana. The following year the genus gave evidence of the growing botanical knowledge of the southwestern United States by the publication by Torrey and Frémont⁴ of *A. tomentosa* from "west of the Rocky Mountains." Fourteen years later, as a result of the activities of the Mexican Boundary Survey, Torrey⁵ published a second species, *A. longiflora*, a very distinct plant of the region about El Paso, Texas.

Some time later the genus came to the attention of Asa Gray during the course of the preparation of the 'Synoptical Flora,'

¹ Sm. in Rees, Cycl. 35: end of art. "Tabernaemontana." 1819.

² Raf. New Fl. N. Am. 4: 58. 1838.

³ A. DC. in DC. Prodr. 8: 384. 1844.

⁴ Torr. & Frém. in Frém. Rept. 1843-1844, 316. 1845.

⁵ Torr. in Rept. Mex. Bound. Surv. 2: 159. 1859.

and in 1877¹ he published two new species from the Southwest, *A. brevifolia* and *A. Palmeri*. The following year when the 'Synoptical Flora'² was issued, there appeared also a new variety of the genus which Gray termed *A. angustifolia* Michx. var. *Texana*. Besides being noteworthy for the contribution of a new variety, Gray's treatment of *Amsonia* in the 'Synoptical Flora' constitutes a scientific and comprehensive treatment of the group in its phylogenetic aspects.

In 1894, in accordance with the Rochester Code of Nomenclature, a double name was made by Britton³ for the type species of the genus. This name, *Amsonia Amsonia*, is still current among some botanists.

K. Schumann,⁴ in Engler and Prantl's 'Natürlichen Pflanzenfamilien,' elaborated upon Gray's treatment in the 'Synoptical Flora' and divided the genus into two sections which he called *Euamsonia* and *Sphinctosiphon*. In the first section, three species were recognized, namely, *A. Tabernaemontana* Walt., *A. ciliata* Walt., and *A. elliptica* (Thunb.) Roem. & Schult., and in the second section, four species, *A. Palmeri* Gray, *A. longiflora* Torr., *A. brevifolia* Gray, and *A. tomentosa* Torr. & Frém.

In the twentieth century numerous additions have been made to the genus *Amsonia*. In 1900 A. A. Heller⁵ elevated Gray's *A. angustifolia* Michx. var. *Texana* to specific rank. In Small's 'Flora of the Southeastern United States' two new species are contained, *A. ludoviciana* Vail⁶ and *A. rigida* Shuttleworth.⁷ Other new specific contributions have been *A. latifolia* M. E. Jones,⁸ 1908, *A. Eastwoodiana* Rydberg,⁹ *A. arenaria* Standley,¹⁰ and *A. hirtella* Standley,¹¹ in 1913. Jepson,¹² in 1925, reduced *A. tomentosa* Torr. to a variety of *A. brevifolia* Gray.

¹ Gray, Proc. Am. Acad. 12: 64. 1877.

² Gray, Syn. Fl. N. Am. 2: 81. 1878.

³ Britton, Mem. Torr. Bot. Club 5: 262. 1894.

⁴ K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. 4²: 143. 1895.

⁵ Heller, Muhlenbergia 1: 2. 1900.

⁶ Vail, in Small, Fl. Southeast. U. S. 935. 1903.

⁷ Shuttlew. in Small, l. c. 1903.

⁸ Jones, Contr. West. Bot. 12: 50. 1908.

⁹ Rydb. Bull. Torr. Bot. Club 40: 465. 1913.

¹⁰ Standl. Proc. Biol. Soc. Wash. 26: 117. 1913.

¹¹ Standl. l. c. 1913.

¹² Jepson, Man. Fl. Pl. Cal. 768. 1925.

Evidently the first printed illustration of an *Amsonia* was one presumably of *A. Tabernaemontana* in Plukenet, *t. 115, fig. 3*, 1769, where it appears as "*Apocynum Virginianum Asclepiadisfolio erectum floribus pallide caeruleis radici crassa.*"

Because of the peculiar distribution of the genus as well as because of its growing need for a taxonomical revision, it was thought appropriate that a rather broad study be made of the genus *Amsonia*. Such a study was begun at the Gray Herbarium of Harvard University under the oversight of Dr. B. L. Robinson and Prof. M. L. Fernald, and completed at the herbarium of the Missouri Botanical Garden under Dr. J. M. Greenman. To Professors Robinson, Greenman, and Fernald, the author wishes to express his obligations most heartily for their kindly criticism and their ready suggestions. To Mr. T. H. Kearney the author is also indebted for much valuable aid with regard to the difficult species of the southwestern United States. Various herbaria have been visited, also, or specimens have been borrowed, and to the curators of each the author would express his gratitude.

GROSS MORPHOLOGY

The genus *Amsonia* is one of the few members of the Apocynaceae which are temperate or subtemperate, and contains within its several species only erect perennial semi-woody herbs.

Roots.—The root system of the group is characteristically fibrous. The crowns usually become woody with increasing age, and produce numerous clustered stems. Latex tubes occur in abundance, as in all the members of the family.

Stems.—The stem system is typically that of an erect perennial and varies relatively little. A mature stem is usually divided into several branches. The species inhabiting the arid regions of the southwestern United States and northern Mexico frequently have stems which are branched to a much greater extent, and much lower upon the stem than the more temperate species of the states of the Southeast and Middle West.

Leaves.—The leaves of the genus are alternate to subverticillate, and vary greatly in size and outline. Through the succession of species, extremes are found in the leaves of *A. Tabernaemontana*, which are broadly ovate-elliptic, usually measur-

ing 3–5 cm. long and 1.5–2.5 cm. broad, petiolate and opposite, to the subverticillate leaves of *A. salpignanthea*, which are linear-lanceolate to linear-filiform, measuring 2–5 cm. long and .5–4 mm. broad, and decidedly sessile. The leaves may also be glabrous to glaucous, as they are in *A. salicifolia*, or densely tomentose, as they occur in *A. tomentosa*. The leaves are always entire, and are never cordate. In only one species, *A. Tabernaemontana*, are the bases of the leaf-blades other than acute when a petiole exists.

Inflorescence.—The inflorescence is a thyrsoid or corymbose cyme. The amount and shape of the inflorescence, however, is varied. The largest inflorescence of the genus is found in *A. Tabernaemontana* var. *Gattingeri*, which frequently contains over fifty blossoms, and the smallest in *A. Palmeri*, which usually has only five or six. The inflorescence may have very inconspicuous bracteoles, as in the subgenus *Euamsonia*, or quite conspicuous bracteoles, giving the whole inflorescence a chaffy appearance, as in the subgenera *Sphinctosiphon* and *Articularia*. The inflorescence may also be surrounded by the foliage, as in *A. arenaria*, or held high above the foliage by a long, nearly leafless stalk, as in *A. ciliata* var. *tenuifolia*. Pedicels may be relatively long, as in *A. Tabernaemontana* var. *salicifolia*, or frequently lacking altogether, as in *A. longiflora*.

Calyx.—The variation in the calyx is marked. In *A. Tabernaemontana* var. *salicifolia* the calyx is 1 mm. long or less in entirety, the lobes being minutely triangular-ovate. In *A. tomentosa* the calyx is as shallow as in the former species, but the lobes are fully 3–5 mm. long and are subulate-aristate. The calyx may be glabrous or pubescent, occasionally becoming sparsely hirsute.

Corolla.—The corolla is regularly five-lobed. The tube dilates upward, and may be unconstricted, as in the subgenus *Euamsonia*, or markedly constricted at the mouth, as in the subgenera *Sphinctosiphon* and *Articularia*. Variation in the length of the tube is great, ranging from 6–8 mm. in *A. ciliata* var. *tenuifolia* and allied species, to 3–3.5 cm. in *A. longiflora* and *A. salpignanthea*, which have the most conspicuous flowers of the genus. The color varies from a clear cerulean blue, tinged to tawny-white in the tube,

in most of the eastern species, to white or a faint livid greenish blue in some of the western species. The tube is always villous within, and may be pubescent or glabrous without. The lobes of the corolla are spreading, and may be ovate to narrowly lanceolate in outline. The length of the lobes varies from one-half the length of the tube to an equal length, save in the large-flowered species of the section *longiflorae* of the subgenus *Sphinctosiphon*, where the ratio of the length of the tube to that of the lobes may be from about 3 : 1 in *A. longiflora* to 5 : 1 in *A. salpignanthera*.

Stamens.—The stamens number five, and are adnate to the corolla-tube well above the middle. The anthers are ovate-lanceolate, acute above, obtuse below, unappendaged, and fertile throughout their entire length. The stamens are free from the stigmatic-cap.

Pistil.—The two carpels of the gynoecium, which are uniloculate and contain many two-seriate anatropous ovules, are united by a common filiform style, which is about the length of the corolla-tube, to a position immediately below the stamens, where it is surmounted by a stigmatic-cap bearing the stigma. The stigmatic-cap is constructed in three elements, the lower of which is a reflexed membranaceous appendage, originating from the summit of the stylar shaft, the central, a tangled mass of short papillae, and the upper, the stigma itself, which may be depressed-capitate or truncate, as in the subgenus *Euamsonia*, or apiculate by two distinct obtuse lobes, as in the subgenera *Sphinctosiphon* and *Articularia*.

Fruit.—The fruit of *Amsonia* is a pair of follicles which are cylindrical and acuminate, and may be slender and continuous, as in the subgenera *Euamsonia* and *Sphinctosiphon*, or torose and definitely articulated into thickish constricted segments, as in the subgenus *Articularia*. In either case the seeds are one-seriate, cylindrical, and unappendaged, but in *Articularia* the endosperm is conspicuously thicker and more corky than in the endosperm of the other subgenera.

SYSTEMATIC POSITION

The genus *Amsonia* is placed in the tribe Plumeroideae of the Apocynaceae because of its free unappendaged stamens.

The characters of an ovary containing six to many ovules, an eglandular calyx, coriaceous fruit, a hypercraterform corolla, and included stamens moreover place the genus in the subtribe Euplumeroideae.

The closest related genus to *Amsonia* appears to be for various reasons *Haplophyton*. The two genera are found in common territory from southern California to southwestern Texas. Morphologically the greatest dissimilarity lies in the seeds which are appendaged in *Haplophyton*. The leaves, which serve to aid the differentiation of the two genera in the 'Synoptical Flora,'¹ are not as widely separated as is ordinarily to be supposed, since they are not absolutely opposite in *Haplophyton* and alternate in *Amsonia*, but are more nearly approximate in the former and frequently subverticillate in the latter. The stamens are nearly alike in both genera, but are somewhat larger in *Haplophyton*. The character of the stigmatic head in that genus is also much like that of the stigmatic-head in the subgenus *Euamsonia* of *Amsonia*, although more elongate, but lacks a membranaceous reflexed appendage. However, a distinct swollen region occurs upon the stylar shaft of *Haplophyton* just below the papillose cap, which might be regarded as a primitive stage in the development of the more elaborate appendage of *Amsonia*. *Rhazya* is also a genus closely related to *Amsonia*, but possesses a disc and a jointed clavuncle among other dissimilarities.

RELATIONSHIP AND DISTRIBUTION OF THE SUBGENERA

The genus *Amsonia*, although relatively a small group, is readily separable into three subgenera, which, while interlocking closely, are distinct and well differentiated entities in the whole. The series of subgenera range in geographical and evolutionary succession from east to west and south in North America, upon which continent the bulk of the species occur, only one species being found in eastern Asia.

The subgenus *Euamsonia* is the largest of the divisions in number of species and varieties and the most widely spread, embracing five species and four varieties in the southeastern United States, and one species in Japan. The second largest

¹ Gray, Syn. Fl. N. Am. 2: 81. 1878.

subgenus with regard to number of species and extent of distribution is *Sphinctosiphon*, which occurs with eight species in the central-southwestern United States and adjacent Mexico, having for its center of distribution southern New Mexico and northern Chihuahua. *Articularia* is the smallest of the subgenera, and contains four species limited to southern California, southern Nevada, southwestern Utah, and western Arizona; while one species, *A. arenaria*, is isolated from the general distribution of the subgenus to which it belongs, in extreme southwestern New Mexico and adjoining Chihuahua.

The situation of *Euamsonia* in having species of the southeastern United States and Japan is by this time of more or less frequent knowledge, and no speculations will be devoted to it, since similar instances have been reported.^{1, 2, etc.} The occurrence of the three subgenera in the southern United States and northern Mexico is, however, of general interest.

A study of the genus in North America suggests forcibly that it is a genus of mesophytic origin which exhibits an increasing adaptation to an arid habitat. *Euamsonia* is the one subgenus of a mesophytic habit, and since it is represented by the relict species in Japan to which reference has already been made, it is taken as the most primitive. The subgenera *Sphinctosiphon* and *Articularia* are plants of distinctly arid habitat, and the morphological differentiation which those groups exhibit are interpreted as divergences from the primitive condition represented by *Euamsonia*.

The genus *Amsonia* is relatively advanced among the Plumerioideae because of its highly differentiated stigmatic-cap, among other characters, and it is upon the basis of further differentiation in that respect that the first subgeneric division is made. In the subgenus *Euamsonia* the stigma proper is depressed-capitate or truncate, and appears merely as the freer summit of the papillose central region of the stigmatic-cap to which reference was made in detail in the previous section concerning Gross Morphology. The mouth of the corolla-tube, moreover, is relatively open, continuing the dilation of the tube. In the

¹ Gray, A. Mem. Am. Acad. N. S. 6: 377-449. 1859.

² Fernald, M. L. Quart. Rev. Biol. 1: 227. 1926.

subgenus *Sphinctosiphon* an evolutionary advance is detected in the elevation of the stigma to the position of two distinct apiculate lobes, and the constriction of the mouth of the corollatube. Such differentiations are obviously of use to the plant for insect pollination in an arid region.

The subgenus *Articularia* demonstrates a further advance in the articulation of the follicles, which are quite slender and continuous in *Euamsonia* and *Sphinctosiphon*, into thickish constricted segments in much the same manner as the legumes of certain desert Leguminosae, beside having the apiculate characters of the stigma. The seeds of the follicles of *Articularia*, moreover, are larger and ovoid, and the endosperm is thickened, but of a light and corky texture, an evident construction to facilitate easy dissemination in an arid habitat. The seeds of *Euamsonia* and *Sphinctosiphon*, on the other hand, are roughly cylindrical with a relatively thin, hard endosperm.

The subgenera of *Amsonia* are remarkable for their interrupted distribution, a factor which lends even sharper distinction to the morphological differences which they display, and suggests certain hypotheses for their origin. *Euamsonia*, with the greatest number of species and varieties, has been found naturally in all of the southeastern United States, with a generally characteristic habitat of moist woods, ravines, or stream-sides, save in its extreme western limits, where *A. ciliata* var. *texana* is found on rocky hillsides and prairies.

Sphinctosiphon, with the next largest number of species, is confined to southwestern Colorado, southeastern Utah, New Mexico, and adjacent portions of Arizona, Chihuahua, and Texas. Thus *Sphinctosiphon* and *Euamsonia* are entirely separate in range, except in south-central Texas, which contains two species of *Euamsonia* and a limited colony of *A. salpignantha* of *Sphinctosiphon*. Besides the anomalous occurrence of *A. salpignantha* within the southwestern limits of *Euamsonia* the nearest that the subgenera approach each other is evidently in western Texas, *Euamsonia* being found in the Wichita Mountains of north-central Texas, and *Sphinctosiphon* in the Guadalupe Mountains about two hundred miles to the southwest. The species of *Sphinctosiphon*, although in an arid region,

partake of the nature of *Euamsonia* in frequenting the borders of ponds, streams, and branches.

Articularia, with the fewest number of species, is confined to southern California, southern Nevada, southwestern Utah, and northwestern Arizona, save for the species *A. arenaria*, which has a distribution analogous to the anomalous distribution of *A. salpignanthera* of *Sphinctosiphon*, occurring separate from the other species with which it has its affinities, in extreme southwestern New Mexico (Grant County), and adjacent Chihuahua, within the distributional area of *Sphinctosiphon*. The species of *Articularia* demonstrate the most extreme endurance for aridity, being found most frequently in the sand of the open desert, whence, it is rather safely supposed, occurs the striking morphological adaptations which they exhibit.

Thus *Sphinctosiphon* and *Articularia* possess rather distinct areas of distribution, save for *A. arenaria* of *Articularia* which occurs fully three hundred miles, to present knowledge, from the known range of its kindred species, a perplexing situation. It is also possible that *A. Eastwoodiana* and *A. Jonesii*, species of *Articularia* and *Sphinctosiphon* respectively, meet in southern Utah and northern Arizona. At any rate, *A. Kearneyana*, occurring in regions midway between the territories of *Sphinctosiphon* and *Articularia*, for reasons which will be advanced later, appears in all probability an hybrid between *A. Palmeri* of the former subgenus and *A. brevifolia* of the latter. Thus it is seen that the subgenera of *Amsonia* occupy essentially distinct and isolated ranges, *Articularia* and *Sphinctosiphon*, the most nearly related of the groups morphologically and ecologically, being also the most neighborly distributed, and both distinctly removed from *Euamsonia*, the supposed primitive subgenus, morphologically and geographically.

If we are to believe that by the Cretaceous the modern angiospermous type of vegetation had become fully established throughout the world,¹ we may assume that the genus *Amsonia* was by that time in a flourishing condition with a wide distribution over the southern half of what is now the United States

¹ Grabau, A. W. Textbook of geology 2: 687. 1922.

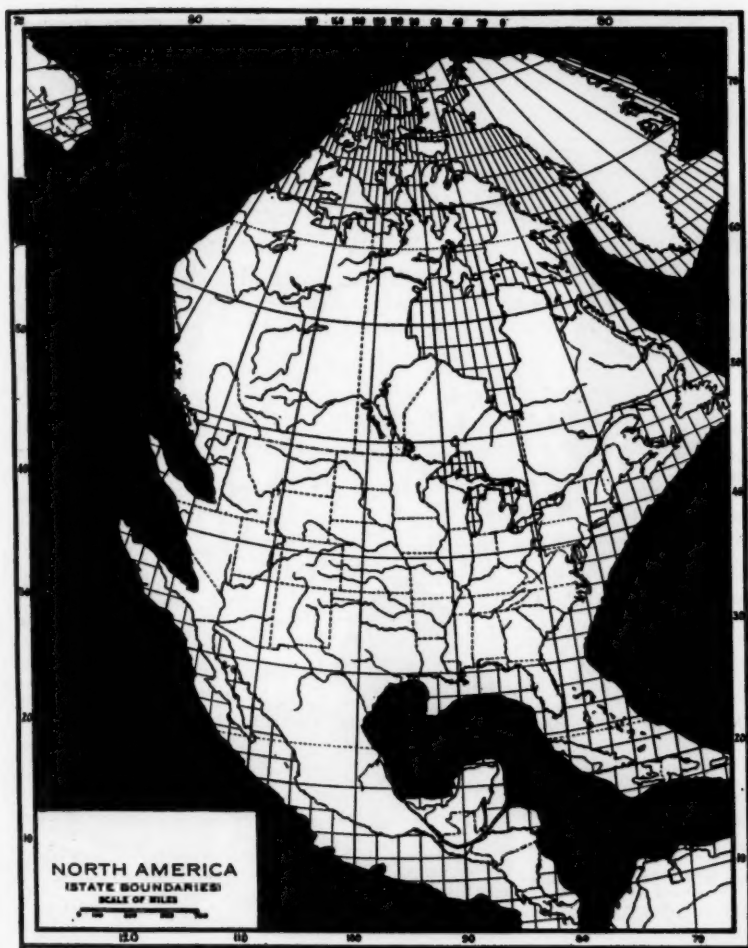


Fig. 1. Land mass of North America in Comanchean time.

and adjacent Mexico.¹ The position of the land masses in

¹ Stopes, M. C. *Ancient plants*, p. 85. 1910. Dr. Stopes wrote, in support of such an assumption: "Specimens of Cretaceous plants from various parts of the world seem to indicate that there was a striking uniformity in the flora of that period all over the globe."

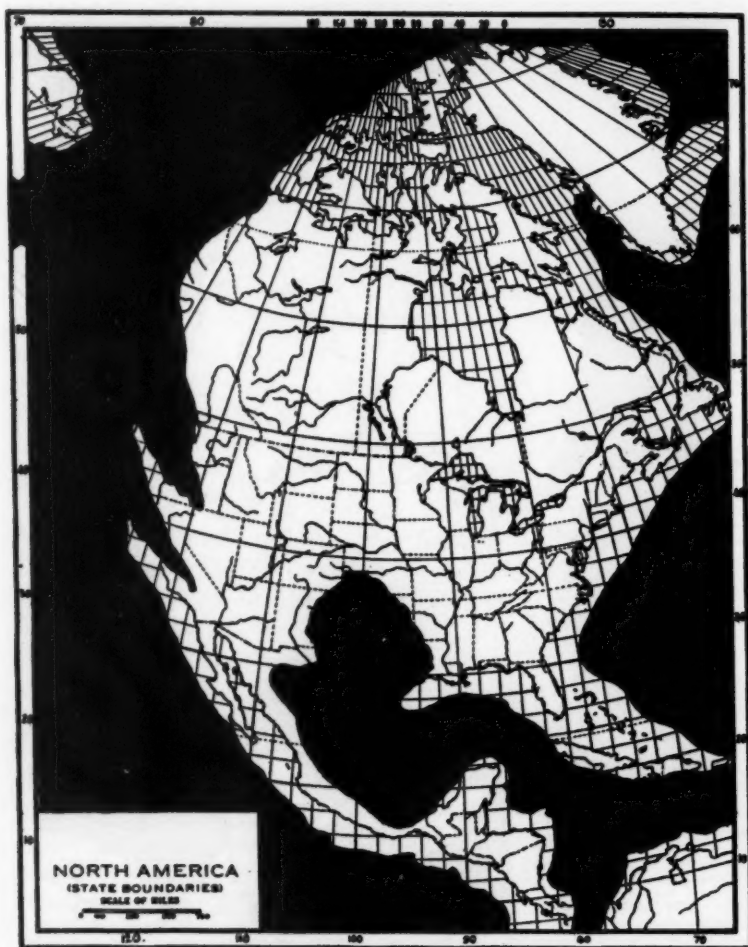


Fig. 2. Land mass of North America in late Comanchean time.

Comanchean, or lower Cretaceous, time would lend support to the speculation that the genus was allowed at that time practically an uninterrupted range (fig. 1), and because of that reason was very likely of a more or less uniform character. The

fact that the genus is now found as a relict in Japan is reason enough for assuming a wide range for its species.

During the late Comanchean time, however, the continuous range supposed for the genus was broken by the inundations of the Colorado Trough (fig. 2), which occurred over nearly the whole of northeastern Mexico, Texas, and parts of Oklahoma, Colorado, Kansas, and New Mexico. This invading sea could scarcely be regarded as less than a most effective opportunity for generic variation through isolation, especially since the vegetation in the isolated mass was by that time bearing evidence of an adaptation to aridity.¹

The Cretaceous time, proper, is well known for the extensive inundations which then occurred widely in North America, and the break in the hypothetical distribution of *Amsonia* was heightened by an increase of the seas of the Colorado Trough, which cut completely through the continent from what is now the coast of the Territory of Mackenzie to the Gulf of Mexico. Troughs of the western coast also caused intrusions during the early periods of the Cenozoic, reaching a climax during Miocene time, when large tracts of southern California and adjacent Lower California and Arizona were separated as islands (fig. 3). By the Pliocene time, North America had largely assumed the shape with which we are now familiar.

With isolated land masses corresponding roughly to the localities of probable origin of the subgenera *Sphinctosiphon* and *Articularia*, a fair degree of credence might be allowed the assumption of their differentiation upon those lands, the first instance of isolation, the intrusion of the Colorado Trough, possibly giving rise to the development of the type of *Sphinctosiphon* from the primitive condition represented at present by *Euamsonia*, and the second, the production of islands by the inundations of the west coast troughs during the Miocene, providing an opportunity for the divergence of the type of *Articularia* from the group now represented by *Sphinctosiphon*. It is

¹ Schuchert, C. Outlines of historical geology. 1924. "In general we may say that after the early upper Cretaceous time . . . the climate the world over was . . . warm temperate in character [p. 612.] With the Miocene, however . . . more or less of desert climates developed in the Cordilleran areas of North America and have prevailed there ever since [p. 626]."

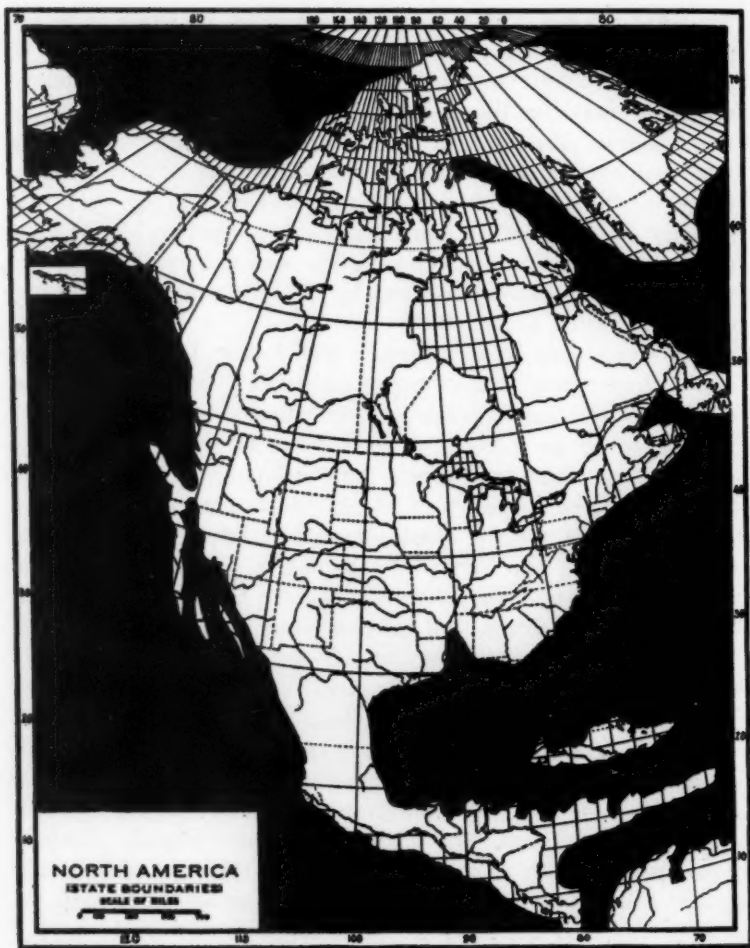


Fig. 3. Land mass of North America in upper Cretaceous time.

believed that the discontinuous areas of the subgenera support the hypothesis offered for their origin. The fact that the distribution of the three subgenera still bears evidence of disruption thousands of years after the Mesozoic and Cenozoic inundations appears quite striking, and bears additional evidence of

the old age¹ of the genus in its inability to reunite its former distribution. In this respect, the genus *Amsonia* offers an interesting parallel to the endemics of the unglaciated regions of boreal America, whose ranges were broken by the Pleistocene glacial phenomena: "These older species in North America have long since passed their period of aggressiveness. 'Left undisturbed they persist in their old habitats, but they fail to move into new and immediately neighboring territory.'"²

ABBREVIATIONS

Abbreviations indicating the herbaria where specimens cited in this monograph are deposited are as follows:

- Baker = C. F. Baker Herbarium of Pomona College.
- F = Field Museum of Natural History Herbarium.
- G = Gray Herbarium of Harvard University.
- MBG = Missouri Botanical Garden Herbarium.
- NE = New England Botanical Club Herbarium.
- NY = New York Botanical Garden Herbarium.
- P = Pomona College Herbarium.
- ANSP = Academy of Natural Sciences of Philadelphia Herbarium.
- PBC = Philadelphia Botanical Club Herbarium.

TAXONOMY

Amsonia Walt. Fl. Carol. 98. 1788; Michx. Fl. Bor. Am. 1: 121. 1803; Pursh, Fl. Am. Sept. ed. 1, 1: 184. 1814; Roem. & Schult. Syst. Veg. 4: 432. 1819; Smith in Rees, Cycl. 35: end of art. "Tabernaemontana." 1819; Elliott, Sketch Bot. S. C. & Ga. 316. 1821; Endl. Gen. Pl. 582. 1838; A. DC. in DC. Prodr. 8: 384. 1844; Pfeiffer, Nom. Bot. 1¹: 156. 1873; Benth. & Hook. Gen. Pl. 2: 703. 1876; Gray, Syn. Fl. N. Am. 2¹: 81. 1878; Durand, Index Gen. Phan. 262. 1888; Baill. Hist. Pl. 10: 180. 1891; Coulter, Contr. U. S. Nat. Herb. 2: 262. 1892; Coville, Contr. U. S. Nat. Herb. 4: 142. 1893;

¹ The presence of *Amsonia* in the Cretaceous period would give to the genus an age, based upon the most capable of present calculations (Schuchert, C. I. c. 485. 1924), of at least 45,000,000 years.

² Fernald, M. L. Persistence of plants in unglaciated areas of boreal America. Mem. Am. Acad. 15: 244. 1925; Antiquity of vascular plants. Quart. Rev. Biol. 1: 227. 1926.

K. Schumann in Engl. & Prantl, Nat. Pflanzenfam. 4²: 143. 1895; Mohr, Contr. U. S. Nat. Herb. 6: 674. 1901; Small, Fl. Southeast. U. S. 934. 1903; Dalla Torre & Harms, Gen. Siph. 406. 1904; Harper, Ann. N. Y. Acad. Sci. 17¹: 175. 1906; Robinson & Fernald in Gray, New Man. ed. 7, 661. 1908; Nelson in Coulter & Nelson, New Man. Rocky Mt. Bot. 385. 1909; Matsumura, Index Pl. Jap. 2: 505. 1912; Wootton & Standley, Contr. U. S. Nat. Herb. 19: 504. 1915; Rydb. Fl. Rocky Mts. 668. 1917; Davidson & Moxley, Fl. South. Cal. 278. 1923; Tidestrom, Contr. U. S. Nat. Herb. 25: 418. 1925; Jepson, Man. Fl. Pl. Cal. 768. 1925.

Ansonia Raf. New Fl. N. Am. 4: 58. 1838.

Lactescent herbaceous caulescent perennials, glabrous or pubescent. Leaves alternate or subverticillate, sessile or petiolate, membranaceous or somewhat thickened and fleshy, entire. Inflorescence a terminal thyrsoid or corymbose cyme. Calyx five-parted, the lobes acuminate or subulate. Corolla salverform, villous within, tube cylindrical, dilating, open or constricted; lobes ovate to lanceolate, spreading or nearly erect. Stamens five, adnate to the corolla-tube above the middle, included; anthers ovate to ovate-lanceolate, obtuse, unappendaged. Disk wanting. Carpels two, united by the filiform style surmounted by a truncate stigmatic-cap. Stigma depressed-capitate, or apiculate by two distinct lobes, surrounded by a spherical papillose mass, and appendaged by a reflexed membrane. Ovules in each carpel many, two-seriate. Follicles two, cylindrical, continuous or articulated. Seeds many, one-seriate, cylindrical, unappendaged. Embryo straight.

Type species: *A. Tabernaemontana* Walt. Fl. Carol. 98. 1788.

SYNOPSIS OF THE SUBGENERA AND SECTIONS

KEY TO THE SUBGENERA

- A. Stigma depressed-capitate or truncate.....Subgenus I. EUAMSONIA
- B. Stigma apiculate by two distinct lobes.
 - a. Follicles continuous, not articulated.....Subgenus II. SPHINCTOSIPHON
 - b. Follicles torose, articulated into thickish constricted segments.....
 -Subgenus III. ARTICULARIA

SUBGENUS I. EUAMSONIA (K. Schumann) Woodson

Subgenus I. EUAMSONIA (K. Schumann) Woodson, n. comb.

§*Euamsonia* K. Schumann in Engl. & Prantl, Nat. Pflanzen-

fam. 4²: 143. 1895; Dalla Torre & Harms, Gen. Siph. 406. 1904.

Bracteoles inconspicuous; orifice of the corolla-tube not constricted in anthesis; stigma depressed-capitate or truncate; follicles slender and continuous, not articulate, fibrous, not horny in texture; seeds irregularly oblong in outline, truncate at either end, variously pitted and wrinkled; plants of the southeastern United States and Japan. Spp. 1-5.

KEY TO THE SPECIES AND VARIETIES

- a. Corolla glabrous without.
 - b. Leaf-blades elliptic, distinctly petiolate throughout.....1. *A. rigida*
 - bb. Leaf-blades oblong-lanceolate to linear, sessile or subsessile above.
 - c. Corolla-tube 6-8 mm. long.
 - d. Stem-leaves 4-15 times as long as broad; inflorescence barely held above the foliage.....2. *A. ciliata*
 - dd. Stem-leaves 15-30 times as long as broad; inflorescence held high above the foliage.....2a. *A. ciliata* var. *tenusifolium*
 - cc. Corolla-tube 9-12 mm. long.
 - d. Corolla-lobes about half as long as the tube; pedicels 3-5 mm. long; species of North America...2b. *A. ciliata* var. *texana*
 - dd. Corolla-lobes about equalling the tube; pedicels 5-10 mm. long; species of Asia.....3. *A. elliptica*
 - aa. Corolla pubescent without.
 - b. Follicles glabrous.
 - c. Leaf-blades ovate to oblong-lanceolate, the bases of the lower obtuse to broadly acute.....4. *A. Tabernaemontana*
 - cc. Leaf-blades lanceolate to linear-lanceolate, the bases of the lower acute to acuminate.
 - d. Inflorescence loose, few-flowered; foliage glabrous, glaucous beneath.....4a. *A. Tabernaemontana* var. *salicifolia*
 - dd. Inflorescence dense, many-flowered; foliage pubescent, glabrate in age.....4b. *A. Tabernaemontana* var. *Gattingeri*
 - bb. Follicles pubescent, at least upon the upper portion.....5. *A. ludoviciana*

1. *Amsonia rigida* Shuttlew. in Small, Fl. Southeast. U. S. 935. 1903; Harper, Ann. N. Y. Acad. Sci. 17¹: 175. 1906.

Pl. 51, figs. 4-6.

Herbaceous perennial from a thickened somewhat woody root; stems 8-15 dm. tall, regularly branched above, glabrous; leaves alternate, numerous, the blades almost exactly elliptic, isophyllous, *i. e.*, the lower and the upper leaves of nearly like outline, green above, glaucous or glaucescent beneath, 2.5-6 cm. long, .5-1.5 cm. broad, distinctly petiolate throughout; flowers rela-

tively numerous in fairly loose cymes; pedicels 5 mm. long or slightly less; calyx 1-1.5 mm. long, glabrous, the lobes triangular-ovate; corolla salverform, the tube 6-8 mm. long, gradually dilating upwards, glabrous without, the lobes lanceolate, 7-10 mm. long, widely spreading; stigmatic-cap about as tall as broad, stigma depressed-capitate; follicles slender, continuous, gradually attenuate, 7-11 cm. long, sessile, glabrous, 7-10-seeded; seeds 5-11 mm. long, oblong in outline, truncate at either end, variously wrinkled and pitted, dark brown.

Distribution: swampy or moist pine forests, northern Florida and southern Georgia.

Specimens examined:

GEORGIA: Alapaha, swampy pine woods, June 25, 1901, *Curtiss 6820* (G, MBG, NY, US); Sumter Co., moist pine barrens, Aug. 21, 1900, *Harper 448* (G, MBG, NY, US, F); same locality, Sept. 6, 1900, *Harper 606* (NY, US); same locality, Aug. 21, 1900, *Harper 440* (NY, US).

FLORIDA: Chattahoochee, May, 1882, *Curtiss* (G); data lacking, *Chapman* (G, ANSP, MBG); St. Marks, June, 1843, *Rugel* (MBG); Chattahoochee, 1891, *Chapman* (MBG).

2. *Amsonia ciliata* Walt. Fl. Carol. 98. 1788; A. DC. in DC. Prodr. 8: 385. 1844; Wood, Classbook Bot. 589. 1860; Chapm. Fl. South. U. S. 343. 1897; Mohr, Contr. U. S. Nat. Herb. 6: 674. 1901; Small, Fl. Southeast. U. S. 935. 1903; Harper, Ann. N. Y. Acad. Sci. 17¹: 175. 1906. Pl. 51, figs. 7-8.

Tabernaemontana angustifolia Ait. Hort. Kew. 1: 300. 1789; Willd. Sp. Pl. 1²: 1247. 1798.

Amsonia angustifolia (Ait.) Michx. Fl. Bor. Am. 1: 121. 1803; Pursh, Fl. Am. Sept. ed. 1, 1: 184. 1814; Roem. & Schult. Syst. Veg. 4: 432. 1819; Ell. Sketch Bot. S. C. & Ga. 317. 1821; Darby, Bot. South. States, 434. 1860; Gray, Syn. Fl. N. Am. 2¹: 81. 1878.

Ansonia ciliata (Walt.) Raf. New Fl. N. Am. 4: 58. 1838.

Ansonia angustifolia (Ait.) Raf. l. c. 1838.

Herbaceous perennial from a thickened woody root; stems 7-15 dm. tall, clustered from the base, erect or slightly ascending, sparsely branched above, the branches ascending, pubes-

cent, glabrous or glabrate in age; leaves numerous, crowded, subverticillate above, slightly heterophyllous, *i. e.*, the lower leaves broader and of a slightly different outline than the upper, linear-lanceolate, or the lower oblong-lanceolate, pubescent, or glabrate in age; inflorescence dense, barely held above the foliage; pedicels 3–5 mm. long, sparsely pubescent; calyx 1–1.5 mm. long, glabrous, or with a few scattered hairs, the lobes triangular-ovate; corolla salverform, the tube 6–8 mm. long, glabrous without, the lobes 7–8 mm. long, oblong-lanceolate, erect or spreading; stigmatic-cap slightly broader than tall, stigma depressed-capitate or truncate; follicles slender, continuous, 9–11 cm. long, gradually attenuate, sessile, glabrous, 7–11-seeded; seeds 5–11 mm. long, oblong in outline, truncate at either end, variously pitted or wrinkled, dark brown.

Distribution: pine forests, occasionally entering fields; North Carolina, South Carolina, southern Georgia, northern Florida, southern Alabama, and northeastern Texas.

Specimens examined:

NORTH CAROLINA: data lacking, *Curtis* (G).

SOUTH CAROLINA: Aiken, April, 1882, *Velden* (MBG); Aiken, sand hills near Graniteville, May 7, 1899, *Eggert* (MBG); Aiken, May, 1869, *Canby 68* (MBG, G, NY); Columbia, woods, May 9, 1899, *Sargent* (G); data lacking, *Ravenel* (G, NY, US); Columbia, dry sandy pine woods, May, 1890, *Taylor* (F).

GEORGIA: Richmond Co., slopes of sand hills about 8 miles west of Augusta, June 10, 1902, *Harper 1319* (US, NY, F); Augusta, date lacking, *Olney & Metcalfe 76* (G); data lacking, *Wilkins* (G).

FLORIDA: Tallahassee, date lacking, *Berg* (NY); Aspalaga, dry pine woods, April, year lacking, *Curtiss 2269* (G, MBG, ANSP, US, F); River Junction, fields and open woods, April 22 and May 16, 1898, *Curtiss 6376* (G, NY, US, MBG); data lacking, *Chapman* (G); Aspalaga, May, 1898, *Chapman* (MBG); Coffee Co., rocky open ground, flood plains of Pea River, May 15, 1925, *E. J. Palmer 27233* (MBG); Chehaw, June 24, 1915, *Drushel 4572* (MBG).

ALABAMA: data lacking, *Durand* (ANSP).

TEXAS: San Marcos, June 6, 1897, *Stanfield* (NY); Mid-

lothian, April 30, 1895, *Plank* (NY); Turtle Creek, Kerr Co., date lacking, *Bray* 239 (US); Orange, April 17, 1899, *Bray* 60 (US).

Although recognizing that *A. ciliata* Walt. antedates *A. angustifolia* (Ait.) Michx., Gray placed Walter's species in synonymy with the latter species, remarking that *ciliata* was an inappropriate name. The specimens with Gray's labels in the Gray Herbarium truly are glabrate or glabrous, being overly matured specimens, hence Dr. Gray's impression. In any event, Walter's name can scarcely be discarded.

2a. Var. *tenuifolia* (Raf.) Woodson, n. comb.

Ansonia tenuifolia Raf. New Fl. N. Am. 4: 58. 1838.

Amsonia salicifolia Pursh var. *ciliolata* A. DC. in DC. Prodr. 8: 384. 1844.

Amsonia ciliata Walt. var. *filifolia* Wood, Classbook Bot. 589. 1860.

Amsonia tenuifolia (Raf.) Harper, Ann. N. Y. Acad. Sci. 17¹: 175. 1906.

Herbaceous perennial from a fibrous root; stems 3-10 dm. tall, single or sparingly clustered from the base, erect or slightly ascending, sparingly branched above, the branches ascending, pubescent or glabrate in age; leaves numerous, crowded, subverticillate, scarcely heterophyllous, *i. e.*, the lower leaves barely broader and of about the same outline as the upper, linear-lanceolate to filiform, pubescent or glabrate; inflorescence dense, held high above the foliage by a slender, usually leafless stalk; pedicels 3-5 mm. long, barely strigose or glabrous; calyx 1-2 mm. long, glabrous, or with a few short hairs, the lobes triangular-attenuate; corolla salverform, the tube 6-8 mm. long, glabrous or slightly canescent without, the lobes 4-6 mm. long, ovate to oblong-lanceolate, erect or spreading; stigmatic-cap about as tall as broad, stigma depressed-capitate or truncate; follicles slender, continuous, 8-14 cm. long; seeds 7-12 mm. long, oblong in outline, truncate at either end, variously pitted or wrinkled, brown.

Distribution: sand-hills and barrens, also rocky margins of streams; North Carolina, South Carolina, Georgia, Florida, Ala-

bama, southern Arkansas, Missouri, Texas, and central Mexico.

Specimens examined:

UNITED STATES:

NORTH CAROLINA: data lacking, *Curtis* (G); White Hall, May 13, 1896, *Biltmore 1400* (US).

SOUTH CAROLINA: Aiken, May 21, 1899, *Eggert* (MBG).

GEORGIA: Altamaha, sand-hills, date lacking, *Chapman* (G); Augusta, sand-hills, June 10, 1902, *Harper 1319* (G, MBG, NY); Bainbridge, low woods bordering Flint River, July 13, 1899, *Curtiss 6476* (G, MBG, NY, US); Bulloch Co., sand-hills along Big Lott's Creek, June 17, 1901, *Harper 915* (G, MBG, NY, US, F); Camilla, Mitchell Co., dry sand barrens, Aug. 7, *Harper 1166* (G, NY, US); Dublin, Laurens Co., sand-hills of Oconee River, April 20, 1904, *Harper 2138* (G, MBG, NY, US, F); Jasper City, 1846-48, *Porter* (G); Dooly Co., dry pine barrens near Gum Creek, Sept. 3, 1900, *Harper 577* (US); Burke Co., Aug. 15, 1897, *Hopkins 83* (NY); Thomson, McDuffie Co., sand-hills, Sept. 9, year lacking *Bartlett 1493* (P); Vidalia, April, 1914, *Huger* (MBG); Macon, date lacking, *Green* (ANSP).

FLORIDA: Bellair, Sept. 3, 1895, *Nash 2546* (G, MBG, US, F); Clarcona, Orange Co., date lacking, *Meislahn 210* (US); Gotha, March 28, 1919, *Nehrling 12* (US); pine woods west of Jacksonville, April, 1848, *Rugel 21* (US, MBG, F, NY); data lacking, 1873, *Fell* (ANSP); Cocoanut Grove, 1899, *Rodman* (G); Sumter Co., grassy pine-barrens, March 11, 1883, *Donnell-Smith* (G); "East Florida," date lacking, *Buckley* (G); "Middle Florida," date lacking, *Eaton* (G); data lacking, *Buckley* (G); Alachua Co., June-July, 1898, *Hitchcock* (MBG); Lake Brantley, Aug. 1, 1895, *Williamson* (ANSP).

ALABAMA: data lacking, *Buckley* (MBG); Bon Secour (near Mobile), June 29, 1893, *Mohr* (US).

MISSOURI: Ozark Co., rocky open ground, bald knobs, near Tecumseh, Oct. 9, 1927, *E. J. Palmer 33031* (MBG); summit of bald knob across river from Tecumseh, Ozark Co., Nov. 11, 1928, *Anderson & Woodson 4000* (MBG).

ARKANSAS: Logan Co., rocky margins of small streams, Oct. 18, 1923, *E. J. Palmer 24203* (G); Hot Springs, Aug. 5, 1879, *Letterman* (MBG); Arkadelphia, May 10, 1884, *Letterman* (MBG).

TEXAS: data lacking, *Wright* (G); Medina Lake, Bandera Co., limestone ledges, creek banks, June 14, 1917, *E. J. Palmer 12262* (MBG); Johnson Co., rocky prairies, April, 1882, *Reverchon 84* (MBG).

MEXICO:

MICHOACAN: Morelia, June, 1901, *Arséne* (F).

2b. Var. *texana* (Gray) Coulter, Contr. U. S. Nat. Herb. 2: 262. 1892.

Amsonia angustifolia Michx. var. *Texana* Gray, Syn. Fl. N. Am. 2¹: 81. 1878.

Amsonia texana (Gray) Heller, Muhlenbergia 1: 2. 1900; Small, Fl. Southeast. U. S. 935. 1903; Rydb. Fl. Colo. 269. 1906; Nelson in Coulter & Nelson, New Man. Rocky Mt. Bot. 385. 1909; Clem. & Clem. Rocky Mt. Fl. 100. 1914.

Herbaceous perennial from a slightly woody root; stems 2-5 dm. tall, usually clustered from the base, erect or slightly ascending or spreading, occasionally pubescent when young, mostly glabrous; leaves alternate, numerous, quite heterophyllous, *i. e.*, the lower leaves broader and of a different outline than the upper, ovate to oblong-lanceolate below, lanceolate to linear-lanceolate above, occasionally with short scattered hairs; inflorescence compact, barely held above the foliage; pedicels 3-5 mm. long; calyx 1.5-2.5 mm. long, glabrous or glabrate, the lobes triangular-lanceolate to subulate; corolla salverform, the tube 9-11 mm. long, glabrous without, the lobes 4-6 mm. long, ovate to ovate-lanceolate, spreading; stigmatic-cap broader than tall, stigma truncate; follicles slender, continuous, 6-10 cm. long, rather abruptly acuminate, sessile, glabrous. 5-15-seeded; seeds 5-11 mm. long, oblong in outline, truncate at the ends, variously pitted or wrinkled, brown.

Distribution: dry and rocky hillsides and prairies; Oklahoma, and Texas.

Specimens examined:

OKLAHOMA: Crusher Spur, Murray Co., rocky mountain-side, April 12, 1913, *Stevens 29* (G, MBG, US); Fort Sill, May 20, 1892, *Sydore* (NY); Tishomingo, on hillsides, common, April 8, 1916, *Houghton 3606* (G); vicinity of Fort Sill, April 12, 1916,

Clemens 11727 (MBG); Cache, Comanche Co., dry hillsides, decomposed granite, July 19, 1917, *E. J. Palmer* 12597 (MBG); Davis, Arbuckle Mts., April 1, 1916, *Emig* 399 (MBG).

TEXAS: Comanche Springs, March, 1849, *Lindheimer* (G, MBG); Dallas, rocky prairies, April, 1875, *Reverchon* (G, NY, MBG); Dallas, dry uplands, March-June, year lacking, *Reverchon* (G, MBG); "Upper Colorado," rocky places, 1847, *Lindheimer* 660 (G TYPE, MBG, US, F); Fort Worth, rocky hillsides, May 7, 1911, *Ruth* 241 (G, NY, ANSP, F); "Witicha Mtns.," July, 1852, *Torrey* (G, NY); data lacking, *Lindheimer* (ANSP, MBG); Dallas, dry soil, April-June, 1877, *Reverchon* 598 (US, MBG); Dallas, common in woods, May 7, 1900, *Bush* 646 (US, NY, MBG); Dallas, rocky prairies, June 30, 1877, *Hall* 515 (US, MBG, NY); Forks, May 27, year lacking, *Reverchon* (MBG); Boerne, Kendall Co., low rocky creek banks, April 6, 1917, *E. J. Palmer* 11471 (MBG); Dallas, rocky hills, West Dallas, June 22, 1899, *Eggert* (MBG); Hood Co., prairies, May 4, 1900, *Eggert* (MBG); Dallas, cement works, April 12, 1902, *Reverchon* (MBG); data lacking, *Lindheimer* 4 (MBG); Gillespie Co., date lacking, *Jermy* 145 (MBG); Dallas, open limestone hills, May 4, 1918, *E. J. Palmer* 13496 (MBG); Lacey's Ranch, Kerr Co., moist rocky creek banks, June 11, 1917, *E. J. Palmer* 12233 (MBG); Bull Creek, near Austin, April 11, 1914, *Young* (MBG); Boerne, Kendall Co., moist rocky creek banks, April 20, 1917, *E. J. Palmer* 11616 (MBG); Dallas, high prairies, April 12, 1902, *Reverchon* 3122 (MBG).

3. *Amsonia elliptica* (Thunb.) Roem. & Schult. Syst. Veg. 4: 432. 1819; A. DC. in DC. Prodr. 8: 384. 1844; Franch. & Savatier, Enum. Pl. Jap. 1: 315. 1874; K. Sch. in Engl. & Prantl, Nat. Pflanzenfam. 4²: 143. 1895; Matsumura, Index Pl. Jap. 2: 505. 1912. Pl. 51, figs. 9-10.

Tabernaemontana elliptica Thunb. Fl. Jap. 111. 1784.

Ansonia elliptica (Thunb.) Raf. New Fl. N. Am. 4: 58. 1838.

"*Amsonia elliptica* Sieb. & Zucc." in Gray, Mem. Am. Acad. 6: 403. 1857.

Herbaceous perennial from a slightly thickened root; stems 4-7 dm. tall, single or clustered from the base, erect or slightly

ascending, glabrous, or very slightly pubescent when young, branched above, the branches ascending or somewhat spreading; leaves alternate, relatively distant, the blades relatively narrow, lanceolate to linear-lanceolate, the lower 5-10 times as long as broad, both the bases and the apices narrowly acute to acuminate, glabrous above, glaucescent beneath, becoming green in age; inflorescence loose, relatively few-flowered, pedicels 5-10 mm. long; calyx 1-2 mm. long, the lobes triangular-lanceolate, glabrous; corolla salverform, the tube relatively broad, 10-12 mm. long, glabrous without; the lobes of about equal length, oblong-lanceolate, spreading; stigmatic-cap about as broad as tall, stigma depressed-capitate or truncate; follicles relatively stout, continuous, or very slightly torose, 4-6 cm. long, sessile, glabrous, 5-10-seeded; seeds 5-10 mm. long, oblong in outline, truncate at either end, variously pitted or wrinkled, brown.

Distribution: northern Japanese Archipelago.

Specimens examined:

JAPAN: Hakodate, 1861, *Maximowicz* (G); Jesso, near Hakodate, 1861, *Albrecht* (G); Todahara, Musashi, May 24, 1891, *Watanabe* (G); Tokio, May 7, 1879, *Matsumura* (US); Musaski, Toda, May 27, 1911, collector lacking (US).

4. *Amsonia Tabernaemontana* Walt. Fl. Carol. 98. 1788; Pers. Syn. 1: 269. 1801; A. DC. in DC. Prodr. 8: 384. 1844; Rept. Torr. Bot. Mex. Bound. Surv. 159. 1859; Gray, Syn. Fl. N. Am. 2^o: 81. 1878; Wood, Classbook Bot. 589. 1860; Gattinger, Tenn. Fl. 63. 1887; Coulter, Contr. U. S. Nat. Herb. 2: 262. 1892; K. Schumann in Engl. & Prantl, Nat. Pflanzenfam. 4^o: 143. 1895; Chapm. Fl. South. U. S. 343. 1897; Robinson & Fernald in Gray, New Man. ed. 7, 661. 1908.

Pl. 51, figs. 11-13.

Anonymus suffrutex Gronov. Fl. Virg. ed. 2, 35. 1762.

Tabernaemontana Amsonia L. Sp. Pl. ed. 2, 2: 301. 1762; Willd. Sp. Pl. 1^o: 1246. 1798.

Tabernaemontana humilis Salisb. Prodr. 148. 1796.

Amsonia latifolia Michx. Fl. Bor. Am. 1: 121. 1803; Pursh, Fl. Am. Sept. ed. 1, 1: 184. 1814; Roem. & Schult. Syst. Veg. 4:

432. 1819; Elliott, Sketch Bot. S. C. & Ga. 316. 1821; Darby, Bot. South. States, 434. 1860.

Amsonia tristis Sm. in Rees, Cycl. 35: end of art. "Tabernaemontana." 1819; A. DC. in DC. Prodr. 8: 384. 1844.

Ansonia latifolia (Michx.) Raf. New Fl. N. Am. 4: 58. 1838.

Amsonia Amsonia (L.) Britton, Mem. Torr. Bot. Club 5: 262. 1894; Britton & Brown, Ill. Fl. 3: 1. 1898; S. Coulter, Rept. Dept. Geol. Ind. 24: 880. 1899; Hitchcock, Fl. Kans. 13. 1899; Gattinger, Fl. Tenn. 137. 1901; Mohr, Contr. U. S. Nat. Herb. 6: 674. 1901; Small, Fl. Southeast. U. S. 935. 1903; Lowe, Miss. State Geol. Surv. Bull. 17: 227. 1921.

Herbaceous perennial from a thickened, slightly woody root; stems 3-10 dm. tall, usually clustered from the base, erect or slightly ascending, branched above, the branches ascending or spreading, occasionally somewhat pubescent when young; leaves alternate, relatively distant, ovate to oblong-elliptic, the bases of the lower obtuse to broadly acute, occasionally sparsely pubescent upon the lower surface when very young; inflorescence relatively small and dense, barely held above the foliage, pedicels 3-5 mm. long; calyx 1-1.5 mm. long, glabrous, the lobes triangular-ovate; corolla salverform, the tube 6-8 mm. long, pubescent without, the lobes 4-6 mm. long, oblong to oblong-lanceolate, spreading; stigmatic-cap about as tall as broad, stigma depressed-capitate; follicles continuous, 8-10 cm. long, rather abruptly acuminate, sessile, glabrous, 5-15-seeded; seeds 5-11 mm. long, oblong in outline, truncate at either end, variously pitted and wrinkled, dark brown.

Distribution: moist woods and waste-lands, river-banks, etc.; South Carolina, Tennessee, Illinois, eastern Missouri, eastern Oklahoma, eastern Kansas, southeastern Arkansas, escaped from cultivation in Massachusetts, New Jersey, Pennsylvania, and Delaware.

Specimens examined:

MASSACHUSETTS: Boston, Back Bay waste-lands, Aug. 12, 1903, *Williams* (G); Hampden, June, 1911, *Knowlton* (NE).

NEW JERSEY: South New England Road, introduced in field, Cold Spring, Cape May Co., July 7, 1918, *Brown* (PBC).

DELAWARE: Wilmington, waste places, June 3–July 18, 1896, *Commons* (PBC).

PENNSYLVANIA: Oakdale, near Philadelphia, June, 1863, *Martindale* (PBC); Philadelphia, Broad Street & Germantown R. R., 1865, *Martindale 4864* (MBG); Gradyville, Delaware Co., June 9, 1898, *Painter* (PBC); near Philadelphia, May, 1889, *Leeds* (PBC); Gradyville, June 3, 1904, *Vail 546* (US).

SOUTH CAROLINA: Greenville Co., ravines near Caesar's Head, Aug. 5, 1881, *J. D. Smith* (G).

TENNESSEE: Knoxville, thicket on Tennessee River bank, April and July, 1890, *Ruth 174* (G); Knoxville, April, 1894, *Ruth 466* (P, US); Knoxville, June, 1898, *Ruth 480* (MBG).

ILLINOIS: Chandlersville, Aug. 19, 1886, *Seymour 1584* (G, P).

MISSOURI: St. Louis, July 2, 1895, *Glatfelter* (G, MBG); St. Louis, date lacking, *Engelmann* (G, MBG); Eagle Rock, uncommon in barrens, June 22, *Bush 11* (MBG, US); uncommon in rich woods, 4 miles e. of Carthage, May 27, 1906, *E. J. Palmer 921* (MBG); Newton Co., cherty barrens, July 15, 1906, *E. J. Palmer 12* (MBG); Carthage, rich woods, May 27, 1906, *E. J. Palmer 818* (MBG); Noel, low ground, May 10, 1915, *Bush 7513* (MBG); Noel, McDonald Co., thickets, hillsides, Sept. 12, 1913, *E. J. Palmer 4305* (MBG); Swan, common in woods, Oct. 4, 1899, *Bush 753* (MBG).

ARKANSAS: Fort Huron, date lacking, *Edward* (G); Fayetteville, May, year lacking, *Harvey 38* (ANSP); Fulton, low ground, April 17, 1905, *Bush 2378* (MBG); Fayetteville, May 10, 1919, *Wells* (US).

LOUISIANA: Hammond, April 10, 1889, *Gallup 4* (US).

OKLAHOMA: Leflore Co., Page, on bank of mountain creek near Rich Mountain, Sept. 8, 1913, *Stevens 2670* (G, US); Page, Leflore Co., on rocky mountain-side, April 25, 1915, *Blakely 3425* (G); Poteau, Leflore Co., July 13, 1915, *E. J. Palmer 8286* (MBG).

KANSAS: Cherokee Co., rocky woods, May 7, 1897, *Hitchcock 76a* (MBG).

4a. Var. *salicifolia* (Pursh) Woodson, n. comb.

Amsonia salicifolia Pursh, Fl. Am. Sept. ed. 1, 1: 184. 1814;

Roem. & Schult. Syst. Veg. 4:432. 1819; Elliott, Sketch Bot. S. C. & Ga. 316. 1821; A. DC. in DC. Prodr. 8: 384. 1844; Darby, Bot. South. States, 434. 1860; Wood, Classbook Bot. 589. 1860; Small, Fl. Southeast. U. S. 935. 1903; Britton, Man. Fl. 737. 1907.

Ansonia salicifolia (Pursh) Raf. New Fl. N. Am. 4: 58. 1838.

Herbaceous perennial from a slightly thickened root; stems 3-5 dm. tall, usually clustered from the base, erect or slightly ascending, glabrous or very slightly pubescent when young, branched above, the branches ascending or somewhat spreading; leaves alternate, the blades relatively narrow, lanceolate to linear-lanceolate, the lower 5-10 times as long as broad, both the base and the apex narrowly acute to acuminate, glabrous above, glaucous or glaucescent beneath, becoming green in age; inflorescence loose, relatively few-flowered, pedicels 3-7 mm. long; calyx about 1 mm. long, the lobes minutely triangular, glabrous; corolla salverform, the tube relatively narrow, 6-10 mm. long, scatteringly pubescent without, the lobes 5-7 mm. long, lanceolate, spreading; stigmatic-cap somewhat broader than tall, stigma depressed-capitate or truncate; follicles relatively slender, continuous or very slightly torose, 8-10-seeded; seeds 5-10 mm. long, oblong in outline, truncate at either end, variously pitted or wrinkled, brown.

Distribution: river-banks and moist thickets generally; Virginia, North Carolina, South Carolina, Georgia, Alabama, Louisiana, Kentucky, Tennessee, Indiana, Illinois, Missouri, Arkansas, and Texas.

Specimens examined:

VIRGINIA: Petersburg, date lacking, *Tuomey* (ANSP).

NORTH CAROLINA: Biltmore, river-banks, May 11, 1897, *Biltmore 81b* (G, MBG, US, NY); same locality, May 2, 1896, *Biltmore 81* (MBG); Weldon, April, 1897, *Williamson* (ANSP); same locality, April 19, 1908, *Williamson* (ANSP); Hot Springs, May 5, 1884, *Smith* (ANSP); Warm Springs, May 6, 1887, *Smith* (ANSP); Columbus, 1897, *Townsend* (US); Statesville, May, 1878, *Hyams* (US); Granville Co., May, 1873, *Faxon* (G); Mt. Tryon, Polk Co., moist rich soil on a level spot along a mountain rill, May, 1918, *Millsbaugh 4030* (F); Weldon, April 19, 1908, *Bartram* (G); data lacking, *Curtis* (G).

SOUTH CAROLINA: Oconee Co., Clemson College, low woods, April 16, 1906, *House 1851* (US, NY).

GEORGIA: Thompson's Mills and vicinity, Gwinnett Co., April 8, 1908, *Allard 197* (US); Macon, date lacking, *Green* (ANSP); Stone Mountain, Yellow River, May 3, 1899, *Sargent 69* (G).

ALABAMA: Albertsville, April 22, 1899, *Hosdy* (US); Chickasaw, rich places in the barrens, April, 1919, *Graves 566* (US); Tuscaloosa, April, 1892, *Ward* (US); Auburn, Lee Co., April 22, 1900, *Earle* (G).

MISSISSIPPI: Pass Christian, May 16, 1924, *Cooper* (MBG); Rolling Fork, April, 1895, *Boyce* (US).

LOUISIANA: Feliciana [East or West?] Parish, *Carpenter* (G); east of Baton Rouge, April 20, 1874, *Joor* (F).

INDIANA: banks of the Wabash River, June, 1868, *Allen* (F).

KENTUCKY: Bowling Green, 1903, *Price* (MBG); barrens of Kentucky River near Hopkinsville, date lacking, *Buckley* (MBG).

TENNESSEE: Franklin Co., May 5, 1898, *Eggert* (MBG); Nashville, 1880, *Hubbard 2268* (G).

ILLINOIS: exact locality lacking, 1845, *Mead* (G); Grantsburg, April 28, 1900, collector lacking (P); Conologue, April, 1924, *Woodson* (MBG).

MISSOURI: bank of Meramec River near Windsor Springs, April 19, 1891, *Douglass* (US); Cave Spring, 1887, *Blankinship* (US); Cave Spring, Greene Co., June 18, 1905, *Standley* (US); Tyson, St. Louis Co., May 19, 1918, *Drushel 3757* (MBG); banks of the Meramec River, Minke, St. Louis Co., May 17, 1919, *Greenman 3944* (MBG); Chadwick, May 15, 1907, *Bush 4461* (MBG).

ARKANSAS: Baker Springs, Howard Co., April 10, 1909, *Kellogg* (MBG); data lacking, *Pitcher* (ANSP).

TEXAS: Beaumont, low wet woods, March 16, 1918, *E. J. Palmer 13090* (MBG).

4b. Var. *Gattingeri* Woodson, n. var.¹

Herbaceous perennial from a thickened slightly woody root;

¹ Var. *Gattingeri* var. nov., plus-minusve pilosa varietatem genuinam simulans differt foliis longioribus basi acutis; corollae tubo lanoso.—Tennessee, Nashville, June, year lacking, *A. Gattinger* (Gray Herb. TYPE).

stems 3–10 dm. tall, pubescent, becoming glabrous, somewhat clustered at the base, erect or ascending, branched above, the branches ascending or spreading; leaves relatively distant, alternate, the blades lanceolate to linear-lanceolate above, the lower 5–10 times as long as broad, both base and apex narrowly acute to acuminate, green, pubescent, frequently densely so, becoming glabrous in age; inflorescence compact, many-flowered, pedicels 2–4 mm. long; calyx 2–4 mm. long, the lobes narrowly triangular, glabrous, or with a few scattered hairs; corolla salverform, the tube 7–10 mm. long, densely pubescent or villous without, especially in the sinuses of the lobes, the lobes 5–8 mm. long, lanceolate, spreading; stigmatic-cap much broader than tall, stigma truncate; follicles slender, continuous or very slightly torose, 9–14 cm. long, acuminate, sessile, glabrous, 7–11-seeded; seeds 5–12 mm. long, oblong in outline, truncate or slightly tapered at the ends, variously pitted or wrinkled, brown.

Distribution: woods and ravines, northern Georgia, Tennessee, Illinois, Missouri, southeastern Kansas, eastern Oklahoma, and northeastern Texas.

Specimens examined:

GEORGIA: Jasper City, 1847, *Porter* (G).

TENNESSEE: Nashville, June, year lacking, *Gattinger* (G TYPE, MBG); Nashville, islands in Cumberland River, September, 1878, *Gattinger* (MBG, NY, ANSP, F).

KENTUCKY: barrens of the Kentucky River, exact locality lacking, 1860, *Short* (MBG).

ILLINOIS: Athens, 1861, *Hall* (G, P, MBG); Olney, Richmond Co., Turkey Creek bottoms, May 19, 1914, *Ridgway* 104 (G, MBG); Grantsburg, April 28, 1900, *Baker* (P); East Hannibal, June 6, 1913, *Davis* 398 (MBG, US); along road west of Fish Lake, St. Clair Co., July 16, 1898, *Norton* (MBG); damp shady thickets, American Bottoms, opposite St. Louis, May, 1845, *Engelmann* (MBG); Queens Lake, Clinton Co., May 20, 1917, *Ledman* (MBG); Venedy, May 18, 1926, *Anderson & Woodson* 5 (MBG); Conologue, May 16, 1926, *Woodson & Stevenson* 41 (MBG).

MISSOURI: Alba, rich bluff woods, April 29, 1909, *E. J. Palmer* 1819 (G, MBG); St. Louis, July 28, 1910, *Sherff* 801 (G, F,

MBG); Webb City, gravelly branches, Sept. 2, 1909, *E. J. Palmer 2620* (G, MBG); Winfield, Lincoln Co., June 7, 1916, *Davis 1403* (MBG); Bower's Mill, Lawrence Co., rich hill-side woods, April 22, 1908, *E. J. Palmer* (MBG); Allenton, June 10, 1884, *Kellogg* (MBG); Elmont, May 23, 1914, *Emig* (MBG); Gascondy, July 21, 1914, *Emig 221* (MBG); Gray's Summit, May 15, 1926, *Greenman 4493* (MBG); Allenton, June, 1880, *Letterman* (MBG, US).

ARKANSAS: Benton Co., date lacking, *Plank* (MBG); Eureka Springs, April 27, 1899, *Trelease* (MBG); Little Rock, May, 1886, *Hasse* (F).

OKLAHOMA: Miami, on dry bank of draw, Aug. 26, 1913, *Stevens 2337* (G, MBG, US); Page, on rocky mountain-side, April 25, 1915, *Buckley 3425* (G, MBG); rocky hills, Wichita Mts. not common, July, 1891, *Sheldon 224* (MBG).

5. *Amsonia ludoviciana* Vail in Small, Fl. Southeast. U. S. ed. 2, 935. 1913.

Herbaceous perennial from a slightly thickened woody root; stems 5-11 dm. tall, pubescent, at least when young, sparingly branched, erect or ascending, the branches erect or ascending; leaves relatively distant, alternate, the blades elliptic, both base and apex acute to acuminate, 5-8 cm. long, essentially glabrous above, densely white-lanose beneath, pedicels 2-4 mm. long; inflorescence relatively dense, several-flowered, pedicels 2-4 mm. long; calyx 2-3 mm. long, the lobes triangular, 1-1.5 mm. long, pubescent; corolla salverform, the tube 5-9 mm. long, densely pubescent or villous without, the lobes about equalling, or slightly exceeding, the tube, lanceolate, spreading; stigmatic-cap about as broad as tall, stigma truncate; follicles slender, continuous, 8-10 cm. long, acuminate, sessile, manifestly pubescent, 6-10-seeded; seeds 5-12 mm. long, oblong-ovoid in outline, truncate at the ends, variously pitted and wrinkled, dark brown.

Distribution: known only from southern Louisiana.

Specimens examined:

LOUISIANA: New Orleans, date lacking, *Ingalls* (NY); Shackynody, April, year lacking, *Hale* (NY).

SUBGENUS II. SPHINCTOSIPHON (K. Schumann) Woodson

Subgenus II. SPHINCTOSIPHON (K. Schumann) Woodson, n. comb.

§*Sphinctosiphon* K. Schumann in Engl. & Prantl, Nat. Pflanzenfam. 4²: 143. 1895; Dalla Torre & Harms, Gen. Siph. 406. 1904.

Bracteoles conspicuous, giving the inflorescence a chaffy appearance; mouth of the corolla-tube markedly constricted at anthesis; stigma apiculate by two distinct obtuse lobes; follicles continuous, not articulated, fibrous, not horny in texture; seeds oblong in outline, truncate at either end, variously pitted and wrinkled; plants of the southwestern United States and northern Mexico. Spp. 6-13.

Section I. MICRANTHAE Woodson. Corolla-tube 1-1.5 cm. long; calyx 1-4 mm. long; follicles 4-7 cm. long; seeds 4-8 mm. long.

KEY TO THE SPECIES

- a. Follicles slender; seeds fertile.
 - b. Corolla-lobes 3-6 mm. long, ovate or oblong.
 - c. Corolla-lobes 3-4 mm. long; plant entirely glabrous. . . . 6. *A. Palmeri*
 - cc. Corolla-lobes 5-6 mm. long; plant pubescent, at least the calyx-lobes.
 - d. Stem and leaves glabrous; pedicels 3-5 mm. long; inflorescence loose. 7. *A. pogonosepala*
 - dd. Stem and leaves pubescent; pedicels 1-2 mm. long, or practically sessile; inflorescence dense.
 - e. Calyx glabrous; inflorescence many-flowered. . . 8. *A. hirtella*
 - ee. Calyx pubescent; inflorescence few-flowered. . . 9. *A. Standleyi*
 - bb. Corolla-lobes 6-8 mm. long, lanceolate. 10. *A. latifolia*
 - aa. Follicles short; seeds sterile. 11. *A. Kearneyana*

6. *Amsonia Palmeri* Gray, Proc. Am. Acad. 12: 64. 1877; Gray, Syn. Fl. N. Am. 2¹: 82. 1878. Pl. 52, figs. 14-15.

Amsonia Fremontii Rydb. Bull. Torr. Bot. Club 40: 465. 1913. *nomen.*

Herbaceous perennial from a somewhat thickened root, glabrous; stems 3-5 dm. tall, usually clustered from the base, erect or slightly ascending, sparingly branched above, the branches ascending; leaves alternate, relatively numerous, oblong-lanceolate to linear-lanceolate above, the blades 2.5-7 cm. long, 4-8 mm. broad; inflorescence relatively few-flowered and loose, held well above the foliage; pedicels 1-3 mm. long, or practically

lacking; calyx 3-4 mm. long, sparsely hairy, the lobes subulate; corolla salverform, the tube constricted at the mouth, 1-1.8 cm. long, the lobes ovate to ovate-oblong, 3-4 mm. long, erect or spreading; stigma apiculate by two distinct obtuse lobes; follicles 4-6 cm. long, acuminate, sessile, glabrous, continuous, 5-10-seeded; seeds 4-8 mm. long, oblong in outline, truncate at either end, variously pitted or wrinkled, chocolate-brown.

Distribution: Arizona and New Mexico.

Specimens examined:

NEW MEXICO: exact locality lacking, 1851-52, *Wright 1669* (G TYPE, MBG).

ARIZONA: exact locality lacking, 1884, *Lemmon 3248* (G); 50 miles s. of Lee's Ferry, June 12, 1890, *M. E. Jones* (P, US); Hillside, May 1, 1903, alt. 3700 ft., *Jones* (MBG); Beale's Spring, date lacking, *Lemmon & Lemmon* (US); exact locality lacking, 1887, *Mearns 152* (NY).

7. *Amsonia pogonosepala* Woodson, n. sp.¹

Herbaceous perennial from a thickened woody root; stems 5-8 dm. tall, glabrous, clustered from the base, erect or slightly ascending, freely branched above, the branches ascending or spreading; leaves alternate, relatively numerous, glabrous, lanceolate to oblong-lanceolate, the blades 1-1.5 cm. broad, 5-7 cm. long, acute to acuminate at both base and apex, petiolate, the petioles 1-3 mm. long; inflorescence loose, relatively many-flowered; pedicels 2-4 mm. long; calyx 3-6 mm. long, the lobes subulate, conspicuously ciliate, 2-5 mm. long; corolla salverform, the tube constricted at the orifice, 12-15 mm. long, glabrous without, the lobes 5-6 mm. long, ovate to oblong, spreading; stigma apiculate by two distinct obtuse lobes; follicles 1.2-8 cm. long, acuminate, sessile, glabrous, continuous, 4-15-seeded; seeds 7-10 mm. long, oblong-truncate in outline, variously pitted or wrinkled, reddish brown.

¹ *Amsonia pogonosepala* sp. nov., humila saepe basaliter ramosa 5-8 dm. ramis erectis vel laxe ascendentibus glabris; foliis lanceolatis oblongo-lanceolatis petiolatis 5-7 cm. longis 1-1.5 cm. latis glabris; lobis calycis piloso-ciliatis subulatis 2-5 mm. longis; corollae lobis ovatis vel ovato-oblongis 5-6 mm. longis tubo clavato dimidio brevioribus distendatis; stigmatibus subtrochleari apice bilobatis; folliculis teretibus gracilibus continuis glabris sessilibus 2-8 cm. longis.—Arizona rocky hills, San Francisco Mts., April, 1881, *H. H. Rusby 256* (MBG TYPE).

Distribution: southern Arizona.

Specimens examined:

ARIZONA: dry rocky hills, San Francisco Mts., April, 1881, *Rusby 256* (MBG TYPE, ANSP, NY); small sandy wash between Apache Junction and Canyon Lake, June 21, 1928, *Harrison & Peebles 5540* (MBG, US); near Mormon Flats, April 1, 1928, *Peebles, Harrison, & Kearney 3820* (US).

8. *Amsonia hirtella* Standley, Proc. Biol. Soc. Wash. 26: 118. 1913; Wootton & Standley, Contr. U. S. Nat. Herb. 19: 505. 1915.

Herbaceous perennial from a somewhat thickened root, hirtellous; stems 3-5 dm. tall, usually clustered from the base, erect or somewhat ascending, very sparingly branched above, the branches ascending; leaves alternate to subverticillate above, relatively numerous, lanceolate to linear-lanceolate, the blades 3-5 cm. long, 2-5 mm. broad, sessile to subsessile; inflorescence dense, relatively many-flowered; pedicels 1-2 mm. long or practically lacking; calyx 4-5 mm. long, glabrous, except for a few scattered hairs at the tips, the lobes subulate; corolla salverform, the tube constricted at the mouth, 12-15 mm. long, glabrous without, the lobes 5-6 mm. long, ovate to ovate-oblong, slightly spreading; stigma apiculate by two distinct obtuse lobes; follicles unknown.

Distribution: known only from southwestern New Mexico.

Specimens examined:

NEW MEXICO: Grant Co., cañons, May 1, 1892, *Mearns 117* (US TYPE).

9. *Amsonia Standleyi* Woodson, n. sp.¹ Pl. 52, figs. 16-17.

Herbaceous perennial from a somewhat thickened woody root, densely pubescent; stems 3-5 dm. tall, usually clustered from the base, erect or slightly ascending, freely branched above, the

5-8 dm. alta; ramis erectis vel laxe ascendentibus; foliis lanceolatis linearibusque plerumque sessilibus 3-7 cm. longis 4-10 mm. latis alternis vel subverticillatis; lobis calycis pilosis lineari-lanceolatis 4-5 mm. longis; corollae lobis ovatis vel ovato-oblongis 5-6 mm. longis tubo subclavato dimidio brevioribus distendatis; stigmatibus subtrochleari apice bilobato; folliculis teretibus gracilibus continuis glabris sessilibus 6-7 cm. longis.—New Mexico, 1851-52, C. Wright (Gray Herb. TYPE).

¹ *Amsonia Standleyi* sp. nov., pilosa humilis saepe basaliter ramosa 3-5 dm. alta; ramis erectis vel laxe ascendentibus; foliis lanceolatis linearibusque plerumque sessilibus 3-7 cm. longis 4-10 mm. latis alternis vel subverticillatis; lobis calycis pilosis lineari-lanceolatis 4-5 mm. longis; corollae lobis ovatis vel ovato-oblongis 5-6 mm. longis tubo subclavato dimidio brevioribus distendatis; stigmatibus subtrochleari apice bilobato; folliculis teretibus gracilibus continuis glabris sessilibus 6-7 cm. longis.—New Mexico, 1851-52, C. Wright (Gray Herb. TYPE).

branches ascending or slightly spreading; leaves alternate to subverticillate above, relatively numerous, lanceolate to linear-lanceolate, the blades 3-7 cm. long, 4-10 mm. broad, narrowed to an inconspicuous petiole, or practically sessile; inflorescence dense, relatively few-flowered; pedicels 1-2 mm. long, or practically lacking; calyx 4-5 mm. long, densely pubescent throughout, the lobes subulate; corolla salverform, the tube constricted at the mouth, 8-10 mm. long, glabrous without, the lobes ovate to ovate-oblong, 5-6 mm. long, spreading; stigma apiculate by two distinct obtuse lobes; follicles 6-7 cm. long, acuminate, sessile, glabrous, continuous, 5-10-seeded; seeds 4-8 mm. long, oblong in outline, truncate at either end, variously pitted and wrinkled, brown.

Distribution: Texas, New Mexico, and Chihuahua.

Specimens examined:

UNITED STATES:

TEXAS: Bofecillos, May 18, 1881, *Havard* (US).

NEW MEXICO: exact locality lacking, 1851-52, *Wright* (G TYPE).

MEXICO:

CHIHUAHUA: Candelaria, Oct. 24, 1911, *Stearns* 228 (US).

This species is named in honor of Mr. Paul C. Standley, who provisionally referred the *Havard* and *Stearns* specimens, bearing fruit only, to *A. hirtella*, in describing that species, but foresaw that when the flowers corresponding to the fruit should be found they would constitute a new species.

10. *Amsonia Jonesii* Woodson, new name.

Amsonia latifolia M. E. Jones, Contr. West. Bot. 12: 50. 1908, not Michx.; Rydb. Fl. Rocky Mts. 668. 1917; Tidestrom, Contr. U. S. Nat. Herb. 25: 418. 1925.

Amsonia texana Rydb. Fl. Rocky Mts. 668. 1917, not Heller.

Herbaceous perennial from a thickened, frequently very woody root, glabrous; stems 2-4 dm. tall, usually much clustered from the base, erect or ascending, sparingly branched, the branches ascending; leaves alternate, numerous, ovate to ovate-oblong, glaucous, the blades 3-5 cm. long, 1-2 cm. broad, petiolate; inflorescence dense, relatively many-flowered; pedicels 3-5 mm.

long; calyx about 1.5 mm. long, the lobes triangular; corolla salverform, 5–8 mm. long, the lobes narrowly oblong-lanceolate, 5–7 mm. long, spreading, slightly pubescent at the tips when in aestivation; stigma apiculate by two distinct obtuse lobes; follicles 5–8 cm. long, acuminate, sessile, glabrous, continuous, 4–8-seeded; seeds 4–6 mm. long, oblong in outline, transversely truncate at either end, variously pitted and sculptured, brown.

Distribution: rocky gorges and canons, southwestern Colorado, southeastern Utah, and northeastern Arizona.

Specimens examined:

COLORADO: Grand Junction, alt. 4500 ft., June 21, 1894, *M. E. Jones 5469* (P); Grand Junction, alt. 4000 ft., May 28, 1895, *M. E. Jones* (P); McElmo Creek, Montezuma Co., July 19, 1895, *Eastwood 72* (G, MBG); Grand Junction, June 21, 1894, *Jones 5476q* (MBG, ANSP, US, NY).

UTAH: Monroe, Sevier Co., alt. 5000 ft., May 24, 1894, *M. E. Jones 6446* (P TYPE, MBG).

ARIZONA: Navajo Wells, alt. 5000 ft., May 24, 1894, *M. E. Jones 5289aa* (P, MBG); Pagumpa, alt. 4000 ft., April 21, 1894, *M. E. Jones 5093* (P, US, NY, MBG).

11. *Amsonia Kearneyana* Woodson, n. sp.¹

Herbaceous perennial from a thickened, somewhat woody root, more or less pilose; stems 4–8 dm. tall, usually clustered from the base, erect or ascending, sparingly branched, the branches ascending; leaves alternate to subverticillate, oblong-lanceolate to lanceolate, 4–7 cm. long, 1–1.5 cm. broad, petiolate, or subsessile; inflorescence dense, many-flowered; pedicels 1 mm. long or practically lacking; calyx 3–5 mm. long, the lobes subulate-aristate, densely pilose-ciliate; corolla salverform, the tube constricted at the orifice, 1–1.2 cm. long, the lobes 3–5 mm. long, oblong to ovate, erect or slightly spreading; stigma apiculate by two distinct obtuse lobes; follicles short and obviously de-

¹ *Amsonia Kearneyana* sp. nov., plus-minusve pilosa basaliter ramosa 4–8 dm. alta; ramis ascendentibus; foliis alternis vel subverticillatis subsessilibus oblongo-lanceolatis 4–7 cm. longis 1–1.5 cm. latis; lobis calycis subulato-aristatis 3–5 mm. longis; corollae tubo longo subclavato 1–1.2 cm. longo lobis ovatis 3–5 mm. longis erectis vel ascendentibus; stigmatibus subtrochleari apici bilobato; folliculis deformis; seminibus sterilibus.—Arizona, Pima Co., South Cañon, April 9, 1928, *F. Thackery 55* (MBG TYPE).

formed but essentially continuous, 2-5 cm. long, 5-7 mm. broad; seeds sterile.

Distribution: southern Arizona.

Specimens examined:

ARIZONA: South Canyon, Baboquivari Mts., May 24, 1926, *Thackery 2018* (US, MBG); South Canyon, Baboquivari Mts., March 29, 1927, *Peebles, Harrison & Kearney 3820* (US, MBG); South Cañon, Pima Co., April 9, 1928, *Thackery 55* (MBG TYPE).

Because of its appearance intermediate between *A. Standleyi* or *A. Palmeri* and *A. brevifolia* or *A. tomentosa*, because of its geographical position, and because of its complete sterility, *A. Kearneyana* is regarded as a natural hybrid between the subgenera *Sphinctosiphon* and *Articularia*. The flowers are decidedly of the type of *A. Palmeri*, with oblong-ovate, erect or ascending corolla-lobes, while the broad foliage is very similar to that of *A. brevifolia* or *A. tomentosa*. However, since several colonies have been found in the same general vicinity, it is thought better to consider it as a distinct species in the light of recent opinions concerning the origin of species by means of hybridization. Since it demonstrates its recent creation by its sterility and its irregular pilosity, it should probably be considered the most recently evolved species of the genus *Amsonia*.

A. Kearneyana is so named in honor of Mr. T. H. Kearney, of the United States Bureau of Plant Industry, who brought the plant to the attention of the author, and furnished much valuable information regarding the genus in Arizona.

Section II. LONGIFLORAE Woodson. Corolla-tube 3-4 cm. long; calyx 4-8 mm. long; follicles 7-9 cm. long; seeds 5-12 mm. long.

KEY TO THE SPECIES

- a. Plant glabrous; corolla-lobes 11-13 mm. long. 12. *A. longiflora*
 aa. Plant pubescent; corolla-lobes 5-7 mm. long. 13. *A. salpignanthe*

12. *Amsonia longiflora* Torr. Bot. Mex. Bound. Surv. 159: 1859; Gray, Syn. Fl. N. Am. 2¹: 82. 1878; Hemsley, Biol. Cent.-Am. Bot. 2: 308. 1881; Wootton & Standley, Contr. U. S. Nat. Herb. 19: 504. 1915. Pl. 52, figs. 18-20.

Herbaceous perennial from a thickened somewhat woody root,

glabrous; stems 3.5–6 dm. tall, usually clustered from the base, erect or ascending, copiously branched at maturity, the branches ascending or spreading; leaves alternate to subverticillate, linear-lanceolate to filiform, 2.5 cm. long, 1–2 mm. broad, sessile; inflorescence relatively loose, usually containing only 5–10 flowers; pedicels 2–5 mm. long; calyx 6–8 mm. long, the lobes subulate-aristate; corolla trumpet-shaped, the tube constricted at the mouth, 3–4 cm. long, the lobes 11–13 mm. long, oblong-lanceolate, spreading; stigma apiculate by two distinct obtuse lobes; follicles slender, continuous, 7–9 cm. long, acuminate, sessile, 5–15-seeded; seeds 5–10 mm. long, elliptic-oblong in outline, truncate at either end, variously pitted or wrinkled, brown.

Distribution: southeastern New Mexico, extreme western Texas, and north-central Mexico.

Specimens examined:

UNITED STATES:

TEXAS: El Paso, 1881, *Vasey* (G, US, MBG); Hood Co., dry rocky prairie, Sept. 5, 1903, *Reverchon 3881* (MBG); El Paso, April, 1852, *Parry* (MBG); El Paso, rocky ravines, *Wright 1168* (G, NY TYPE, MBG); data lacking, *Wright 72* (NY).

NEW MEXICO: base of Sacramento Mt., Alamogordo, April 14, 1902, *Rehn & Viereck* (ANSP); in arroyo, base of foothills, Alamogordo, May 19, 1902, *Rehn & Viereck* (ANSP); Rio Gila, Aug. 15, 1902, *Wootton* (US).

ARIZONA: Sonoika Creek, south of Patagonia, April 15, 1908, *Tidestrom 848* (US).

MEXICO:

DURANGO: vicinity of the city of Durango, April–Nov., 1896, *E. Palmer 90* (G, MBG, NY).

13. *Amsonia salpignantha* Woodson, n. sp.¹ Pl. 52, figs. 21–22.
Herbaceous perennial from a thickened somewhat woody root,

¹ *Amsonia salpignantha* sp. nov., pilosa vel scabra basaliter ramosa 2–3.5 dm. alta; ramis erectis vel ascendentibus; foliis multis alternis vel subverticillatis sessilibus lineari-lanceolatis filiformibusque 2–5 cm. longis .5–4 mm. latis; lobis calycis lineari-lanceolatis 4–5 mm. longis; corollae tubo longo subclavato 3–4 cm. longo; corollae lobis ovatis 5–7 mm. longis distendatis; stigmatibus subtrochleari apici bilobato; folliculis teretibus gracilibus continuis glabris sessilibus 7–9 cm. longis.—Texas, Hamilton Co., rocky prairies on the Cowhouse Creek, May, 1884, *J. Reverchon 1557* (MBG TYPE).

pubescent, scabrous in age; stems 2-3.5 dm. tall, usually clustered from the base, erect or ascending, branched, the branches ascending; leaves numerous, alternate to subverticillate, linear-lanceolate to filiform, 2-5 cm. long, .5-4 mm. broad, sessile; inflorescence relatively dense, containing usually 10-30 flowers; pedicels 1-4 mm. long, or practically lacking; calyx 4-5 mm. long, the lobes subulate or narrowly lanceolate; corolla trumpet-shaped, the tube constricted at the mouth, 3-4 cm. long, glabrous without, the lobes 5-7 mm. long, oblong-ovate, spreading; stigma apiculate by two distinct obtuse lobes; follicles slender, continuous, 7-9 cm. long, acuminate, sessile, 5-15-seeded; seeds 5-12 mm. long, oblong in outline, truncate at either end, variously pitted or wrinkled, brown.

Distribution: southwestern Texas and Chihuahua.

Specimens examined:

UNITED STATES:

TEXAS: Hamilton Co., 1885, *Reverchon 99* (G, MBG); exact locality and date lacking, *Pope* (G); rocky prairies on the Cowhouse Creek, Hamilton Co., May, 1884, *Reverchon 1557* (F, MBG TYPE); Limpio Mts., 1883, *Havard* (US); Austin, 1880, *Oberwetter* (US); Del Rio, Dec. 7, 1891, *Plank* (NY).

MEXICO:

CHIHUAHUA: exact locality lacking, 1852, *Wright 1671* (G).

SUBGENUS III. ARTICULARIA Woodson

Subgenus III. ARTICULARIA Woodson, n. subgen.

§*Sphinctosiphon* K. Schumann in Engl. & Prantl, Nat. Pflanzenfam. 4²: 143. 1895, in part; Dalla Torre & Harms, Gen. Siph. 406. 1904, in part.

Bracteoles conspicuous, giving the inflorescence a somewhat chaffy appearance; mouth of the corolla-tube markedly contracted in anthesis; stigma apiculate by two distinct obtuse lobes; follicles torose, articulated into thickish constricted segments, horny, not fibrous in texture; seeds elliptic in outline, rounded or pointed at the ends, rarely truncate, relatively smooth and corky; plants of the southwestern United States and northern Mexico. Spp. 14-17.

KEY TO THE SPECIES

- a. Plant glabrous, or with but scattered hairs.
 - b. Leaves ovate to ovate-lanceolate above; corolla-tube about 10 mm. long.....14. *A. brevifolia*
 - bb. Leaves lanceolate to linear above; corolla-tube about 15 mm. long.15. *A. Eastwoodiana*
- aa. Plant villous or tomentose.
 - b. Leaves ovate to ovate-lanceolate, petiolate.....16. *A. tomentosa*
 - bb. Leaves lanceolate to linear, sessile or subsessile.....17. *A. arenaria*

14. *Amsonia brevifolia* Gray, Proc. Am. Acad. 12: 64. 1877; Gray, Syn. Fl. N. Am. 2: 81. 1878; Watson, Bot. Cal. 2: 462. 1880; Coville, Contr. U. S. Nat. Herb. 4: 142. 1893; Wooton & Standley, Contr. U. S. Nat. Herb. 19: 505. 1915; Rydb. Fl. Rocky Mts. 668. 1917; Davidson & Moxley, Fl. South. Cal. 278. 1923; Tidestrom, Contr. U. S. Nat. Herb. 25: 418. 1925; Jepson, Man. Fl. Pl. Cal. 768. 1925. Pl. 53, figs. 26-28.

Herbaceous perennial from a thickened fibrous root, glabrous; stems 1.5-3.5 dm. tall, usually clustered from the base, erect or ascending, sparingly branched; leaves alternate, numerous, ovate-oblong to oblong-lanceolate, 2-3 cm. long, .5-1.5 cm. broad, acute to acuminate at either end; inflorescence dense, much divided at maturity; pedicels .5-1.5 mm. long or practically lacking; calyx 2-4 mm. long, the lobes subulate, bluish tinted; corolla salverform, the tube constricted at the mouth, 7-10 mm. long, the lobes ovate to ovate-oblong, 4-6 mm. long, spreading; stigma apiculate by two distinct obtuse lobes; follicles 5-7 cm. long, torose, articulated into thickish constricted segments, sessile, glabrous, 3-10-seeded; seeds 5-7 mm. long, elliptic-lanceolate in outline, sharply truncate at one or both ends, never tapering sharply, 8-10 mm. long, 3.5-4 mm. broad, smooth or slightly wrinkled, yellowish-brown.

Distribution: deserts and mountain slopes, southwestern Utah, northwestern Arizona, southern Nevada, and southern California.

Specimens examined:

UTAH: Kanab, Logan Co., 1872, *Thompson* (G); exact locality and date lacking, 1874, *Parry* (G); Garfield Co., 1883, *Siler* (ANSP).

ARIZONA: Mokiah Pass, 1877, *E. Palmer* 302 (G TYPE).

NEVADA: Eldorado Cañon at Nelson, alt. 3000 ft., April 30, 1907, *M. E. Jones* (P); 22 miles south of Searchlight, March 26, 1924, *Jaeger* (P); Las Vegas, June, 1915, *K. Brandegee* (P); Ashmeadows, alt. 3000-4000 ft., May-Oct. 1898, *Purpus 5988* (P); Cottonwood Springs, Las Vegas Valley, April 30, 1891, *Bailey 1885* (US).

CALIFORNIA: Mojave region, June, 1876, *E. Palmer 435* (G, MBG, ANSP, US); Mojave Desert near San Bernardino, 1880, *Lemmon* (G); Colorado Desert, in desert sands, April 24, 1921, *Spencer 1778* (G); San Bernardino, May, 1882, *Parish 1332* (G, MBG, US); San Bernardino Co., north slope of San Bernardino Mts., alt. 4000-6000 ft., June 15, 1895, *Parish 3765* (G); Hesperia, in desert sand, Mojave Desert, alt. 3100 ft., May 8, 1917, *Spencer 347* (G, P); Kelso, alt. 3000 ft., May 2, 1906, *M. E. Jones* (P); Keyes' Ranch, alt. 3500 ft., common along a wash, May 7, 1922, *Munz & Johnston 5253* (Baker); Corn Springs, rocky slope, high gorge, alt. 2500 ft., *Munz & Keck 4843* (Baker); Goffs, Mohave Desert, March 28, 1924, *Jaeger* (P); entrance to Deep Creek, slope of San Bernardino Mts., alt. 3500 ft., May 9, 1921, *Jaeger 288* (Baker); Quail Springs, Morango Pass, alt. 4000 ft., April 30, 1921, *Munz 4535* (Baker); Cactus Flat, San Bernardino Co., alt. 6000 ft., June 25, 1926, *Munz 10505* (Baker); Cottonwood Springs, E. Riverside Co., March 26, 1926, *Jaeger* (P); Cushenberry Canyon, San Bernardino Co., June 1, 1892, *Parish 2411* (F); Willow Creek Mt., Panamint Mts., May 22, 1891, *Coville & Funston 825* (US); Mojave Desert, April-May, 1906, *Saunders* (ANSP); Cottonwood Pass, Riverside Co., May, 1905, *Hall 6006* (US); same locality, April 12, 1924, *Evermann* (MBG).

As an instance of the manner in which specific criteria have been applied in the present paper, the case of the specific individuality of *A. brevifolia* Gray and *A. tomentosa* Torr. & Frém. may be of interest, particularly to southwestern botanists. The two species mentioned are both members of the subgenus *Articularia* and inhabit portions of southern California, southern Nevada, and southwestern Utah, and are seldom found separately. Jepson,¹ in 1925, came to the decision that they rep-

¹ Jepson, W. L. Man. Fl. Pl. Cal. 768. 1925.

resented variation only, and reduced *A. tomentosa* to a variety of *A. brevifolia*, although if either should be reduced, the former should remain since it antedates the latter by thirty-two years. The important difference between the two species is the remarkable pubescence of *A. tomentosa*, a character which is not known to vary, judging from the copious herbarium material which the writer has been privileged to examine. *A. tomentosa* is always remarkably pubescent, even to the mature follicles, while *A. brevifolia* is always found to be completely glabrous. Moreover, the seeds of the two species are distinct, a fact which is evidently little appreciated. The seeds of *A. brevifolia* are sharply truncate at one or both ends and never taper sharply, measuring 8-10 mm. long and 3.5-4 mm. broad. The seeds of *A. tomentosa* taper decidedly at both ends and are slightly arcuate, measuring from 12 to 13 mm. long and 3 to 4 mm. broad. Illustrations of the seeds are to be found in pl. 53. In the presence of the seed difference and the non-intergradation of the pubescence or glabrouisity of the two species, it has been thought advisable to treat the species as representing a striking affinity rather than as varieties.

15. *A. Eastwoodiana* Rydb. Bull. Torr. Bot. Club 40: 465. 1913; Rydb. Fl. Rocky Mts. 668. 1917; Tidestrom, Contr. U. S. Nat. Herb. 25: 418. 1925.

Herbaceous perennial from a thickened fibrous-woody root, glabrous; stems clustered from the base, 3-5 dm. tall, erect or ascending, branched from near the base, the branches ascending or spreading; leaves alternate, rather distant, oblong-lanceolate below to linear-lanceolate above, 3-5 cm. long, .3-1 cm. broad, acute at either end, subsessile; inflorescence relatively small, loose; pedicels 4-7 mm. long; calyx 2-2.5 mm. long, the lobes subulate; corolla salverform, the tube constricted at the mouth, 1-2 cm. long, the lobes 4-6 mm. long, oblong, spreading; stigma apiculate by two distinct obtuse lobes; follicles 5-8 cm. long, torose, articulated into thickish constricted segments, sessile, glabrous, 3-5-seeded; seeds elliptic in outline, tapered at one or both ends, 14-15 mm. long, 4-5 mm. broad, smooth or slightly wrinkled, reddish brown.

Distribution: stream margins and ravines, Utah and Arizona.

Specimens examined:

UTAH: San Juan Co., Willow Creek, July 14, 1895, *Eastwood* 73 (G, MBG); San Rafael Swell, Emery Co., May 12, 1914, *M. E. Jones* (P); Moab, June 6, 1913, *M. E. Jones* (P); 10 miles east of Holbrook, June 22, 1901, *Ward* (NY TYPE, US).

ARIZONA: Lee's Ferry, June 13, 1890, *M. E. Jones* (P, MBG); Kayenta, 1922, *Weatherill* (NY).

16. *Amsonia tomentosa* Torr. & Frém. in Frém. Rept. 1843-44, 316. 1845; Walpers, Ann. Bot. Syst. 1: 504. 1849; Rept. Torr. Bot. Mex. Bound. Surv. 158. 1859; Gray, Syn. Fl. N. Am. 2^d: 81. 1878; Hemsley, Biol. Cent.-Am. Bot. 2: 308. 1881; Rydb. Fl. Rocky Mts. 668. 1917; Davidson & Moxley, Fl. South. Cal. 278. 1923; Tidestrom, Contr. U. S. Nat. Herb. 25: 418. 1925. Pl. 53, figs. 23-25.

Amsonia brevifolia Gray var. *tomentosa* (Torr. & Frém.) Jepson, Man. Fl. Pl. Cal. 768. 1925.

Herbaceous perennial from a slightly woody root, densely tomentose; stems 3-4 dm. tall, usually clustered at the base, erect or ascending, branched, the branches ascending or spreading; leaves alternate, rather numerous, ovate-oblong below to oblong-lanceolate above, 2-4 cm. long, 1-1.5 cm. broad, acute at either end, the apices of the upper leaves conspicuously attenuate; inflorescence small, very dense, usually held well above the foliage; pedicels .5-2 mm. long or practically lacking; calyx 2-3 mm. long, the lobes subulate; corolla salverform, the tube 5-8 mm. long, markedly constricted at the mouth, the lobes 4-7 mm. long, ovate to oblong, spreading; stigma apiculate by two distinct obtuse lobes; follicles 6-8 cm. long, articulated into thickish constricted segments, sessile, conspicuously tomentose, 3-7-seeded; seeds elliptic in outline, sharply tapering at both ends, and slightly arcuate, 12-13 mm. long, 3-4 mm. broad, reddish-brown.

Distribution: mountain slopes and deserts, southern Nevada and southern California.

Specimens examined:

NEVADA: Eldorado Canon at Nelson, alt. 3000 ft., April 30, 1907, *M. E. Jones* (P).

CALIFORNIA: Cactus Ranch, Cushenberry Canon, San Bernardino Co., alt. 5500 ft., June 1, 1892, *Parish 2412* (G); Mojave Desert, San Bernardino Co., June 5, 1915, *Parish 10244* (G); San Bernardino Co., north slopes San Bernardino Mts., alt. 4000–6000 ft., June 15, 1895, *Parish 3769* (G); Colorado Desert, in desert sands, alt. 3190 ft., 1921, *Spencer 1778a* (G); One-thousand Palms Canon, upper portion Colorado Desert, April 1, 1921, *Jaeger 60* (Baker); Kelso, alt. 4000 ft., May 2, 1906, *M. E. Jones* (P, MBG); One-thousand Palms Canon, alt. 2700 ft., April 10, 1921, *Jaeger 1173* (Baker); Keyes' Ranch, alt. 3500 ft., common along wash, May 7, 1922, *Munz & Johnston 5252* (Baker); vicinity of Corn Springs, Chuckwalla Mts. Colorado Desert, rocky slope in high gorge, alt. 2500 ft., April 9–12, 1922, *Munz & Keck* (Baker).

17. *Amsonia arenaria* Standley, Proc. Biol. Soc. Wash. 26: 118. 1913; Wootton & Standley, Contr. U. S. Nat. Herb. 19: 505. 1915. Pl. 53, figs. 29–30.

Herbaceous perennial from a thickened slightly woody root, tomentose; stems 2–4 dm. tall, clustered from the base, erect or ascending, branched, the branches short, ascending; leaves numerous, crowded, alternate to subverticillate, sessile, linear-lanceolate to filiform, slightly fleshy, the midveins usually furrowed, 4–6 cm. long, 1–5 mm. wide; inflorescence dense, not usually held above the foliage; pedicels .5–3 mm. long or practically lacking; calyx 4–7 mm. long, the lobes subulate; corolla salverform, the tube 8–10 mm. long, the lobes ovate-oblong to ovate-lanceolate, 5–8 mm. long, spreading; stigma apiculate by two distinct obtuse lobes; follicles glabrous, 5–8 cm. long, torose, articulated into 2–7 thickish constricted segments, sessile, glabrous, 2–7-seeded; seeds 1–1.5 cm. long, elliptic-arcuate in outline, sharply tapering at both ends, 3–4 mm. broad, nearly smooth, light brown.

Distribution: gravelly plains and mountain slopes; Texas, New Mexico, Arizona, and Chihuahua.

Specimens examined:

UNITED STATES:

TEXAS: exact locality lacking, 1857, *Thurber 138* (F).

NEW MEXICO: San Andreas Mts., 1913, *Wooton* (G, US); exact locality lacking, 1852, *Wright 1670* (G, MBG); Turney Range, Dona Ana Co., Sept. 23, 1912, *Wooton* (US); Strauss, rolling hills, 1912, *Stearns* (MBG).

ARIZONA: Cameron, infrequent, sand, June 7, 1922, *Hanson 160* (F); same locality, along wash, June 8, 1922, *Hanson 159* (MBG).

MEXICO:

CHIHUAHUA: between Laguna de Guzman and Laguna Santa Maria, July 16, 1891, *Hartmann 724* (G); gravelly plains near Lake Guzman, alt. 4000 ft., April 9, 1898, *Pringle 6796* (G, P, MBG); among rocks, Ojo de Vaca to Los Plagas, June, 1851, *Thurber 315* (G).

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| Allen, T. F. — (4a). | Clemens, Mrs. J. <i>11727</i> (2b). |
| Anderson, E. S. & Woodson, R. E., Jr. <i>5</i> (4b); <i>4000</i> (2a). | Commons, A. — (4). |
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| Brown, O. E. — (4). | Eggert, H. — (2); — (2b); — (4a). |
| Buckley, S. B. — (2a); — (4a). | Emig, W. H. <i>399</i> (2b); — (4b). |
| Bush, B. F. <i>646</i> (2b); <i>11</i> , <i>753</i> , <i>2378</i> , <i>7513</i> (4); <i>4461</i> (4a). | Engelmann, G. — (4); — (4b). |
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- Evermann, B. W. — (14).
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- Siler, A. L. — (14).
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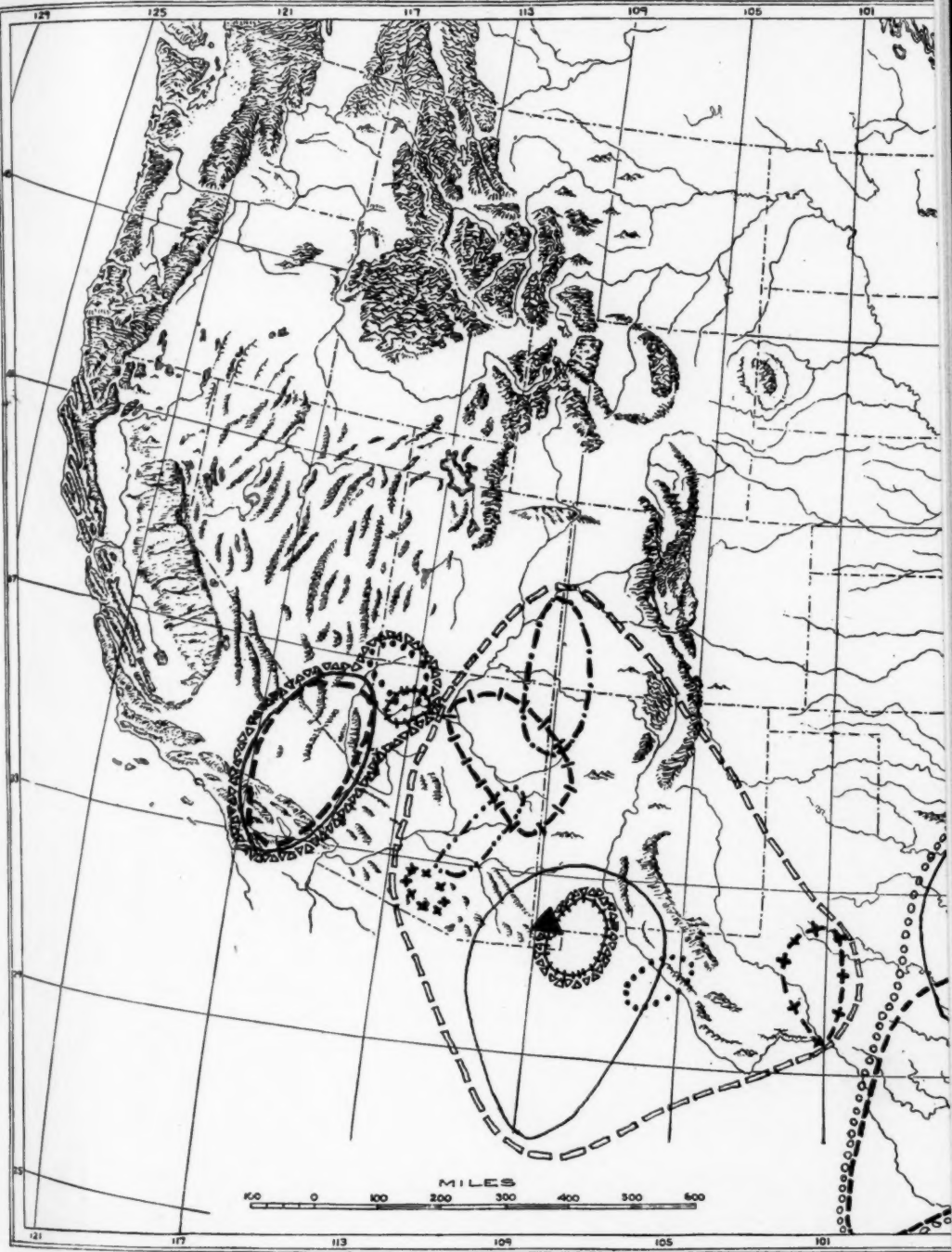
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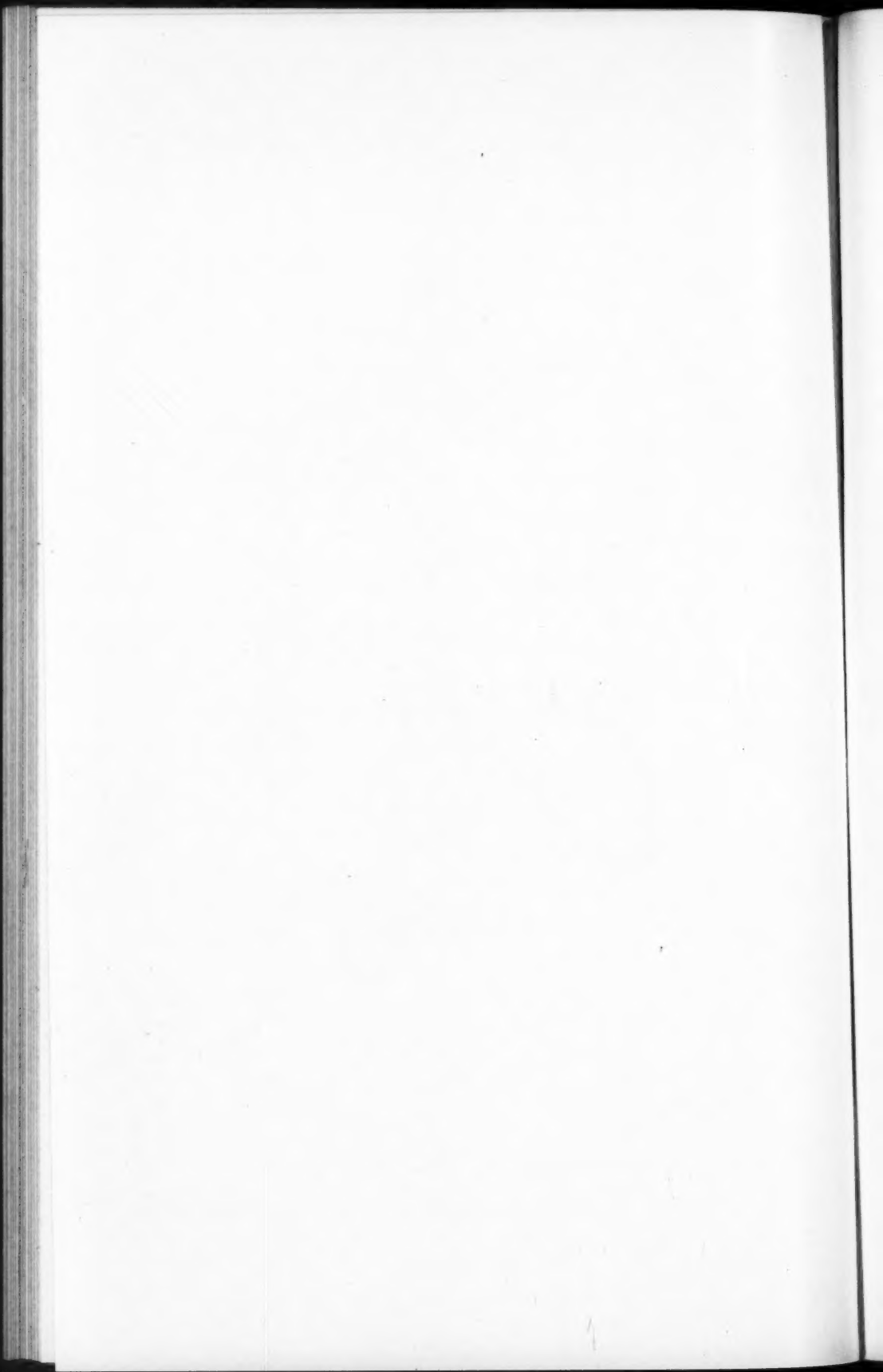
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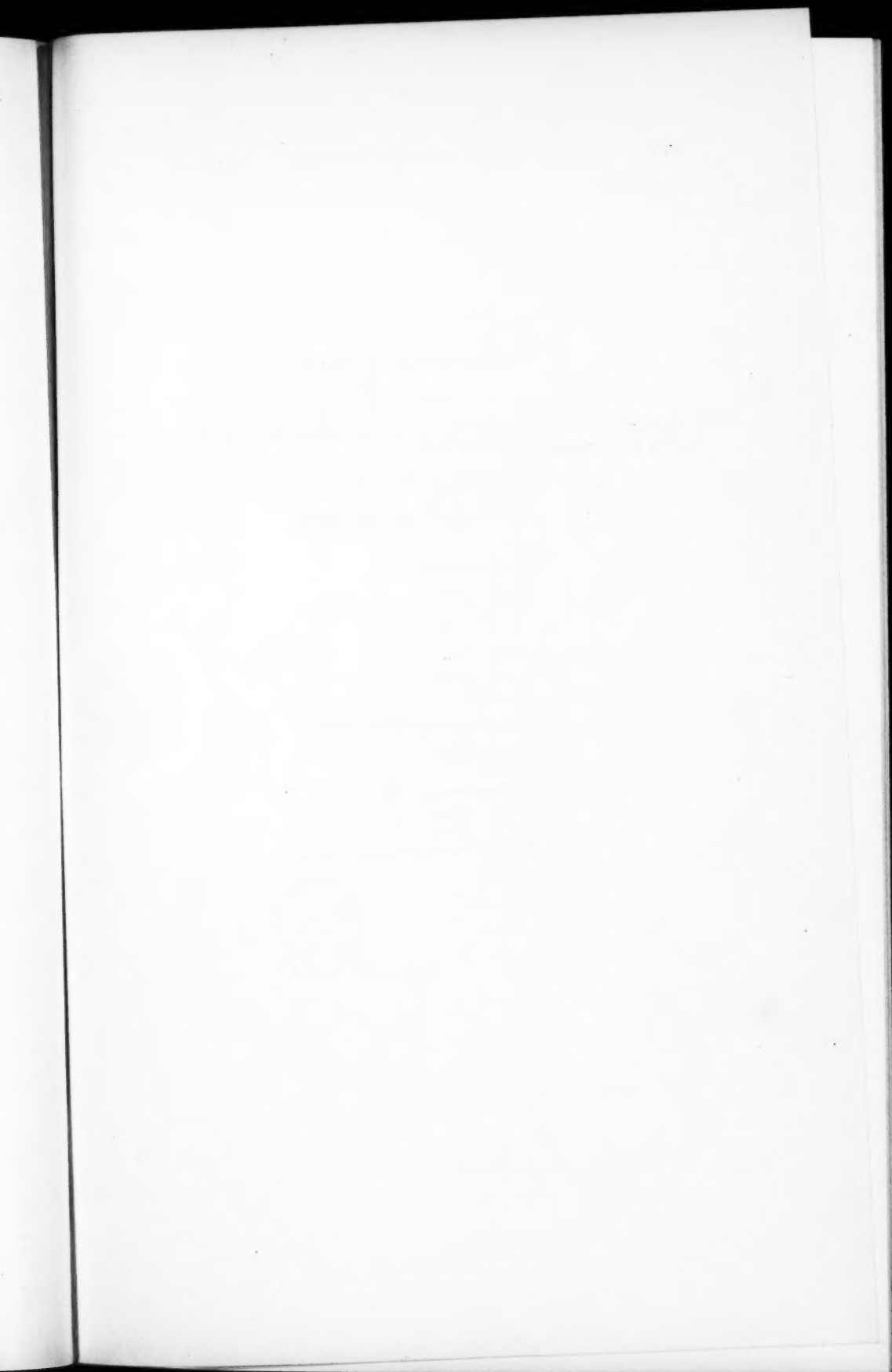
PLATE 50

Map of the geographical distribution of *Amsonia* in North America.oooo subgenus *Euamsonia* (K. Schumann) Woodson.—— *A. Tabernaemontana*.—— *A. ciliata*.—— *A. rigida*...... *A. ludoviciana*.==== subgenus *Sphinctosiphon* (K. Schumann) Woodson.-|- *A. Palmeri*..... *A. Standleyi*.+++ *A. Kearneyana*.—— *A. longiflora*.-|- *A. salpignantha*.-.- *A. Jonesii*.▲ *A. hirtella*.~~~~~ subgenus *Articularia* Woodson.—— *A. brevifolia*.—— *A. tomentosa*..... *A. Eastwoodiana*.++++ *A. arenaria*.

NOTE: Since the preparation of Plate 50, *Amsonia ciliata* var. *tenuifolia* has been found locally in extreme south-central Missouri (*E. J. Palmer 33031*; *Anderson & Woodson 4000*), thus extending the known distribution of that species from central Arkansas.







EXPLANATION OF PLATE

PLATE 51

Illustrations of the subgenus *Euamsonia*, with comparison to *Haplophyton*; all figures $\times 2$ except when otherwise noted.

Haplophyton cimicidium A. DC.

Fig. 1. Flower. $\times 1$.

Fig. 2. Front and side of stamen.

Fig. 3. Pistil.

A. rigida Shuttlew.

Fig. 4. Flower.

Fig. 5. Front and side of stamen.

Fig. 6. Pistil.

A. ciliata Walt.

Fig. 7. Flower.

Fig. 8. Pistil.

A. elliptica (Thunb.) Roem. & Schult.

Fig. 9. Flower.

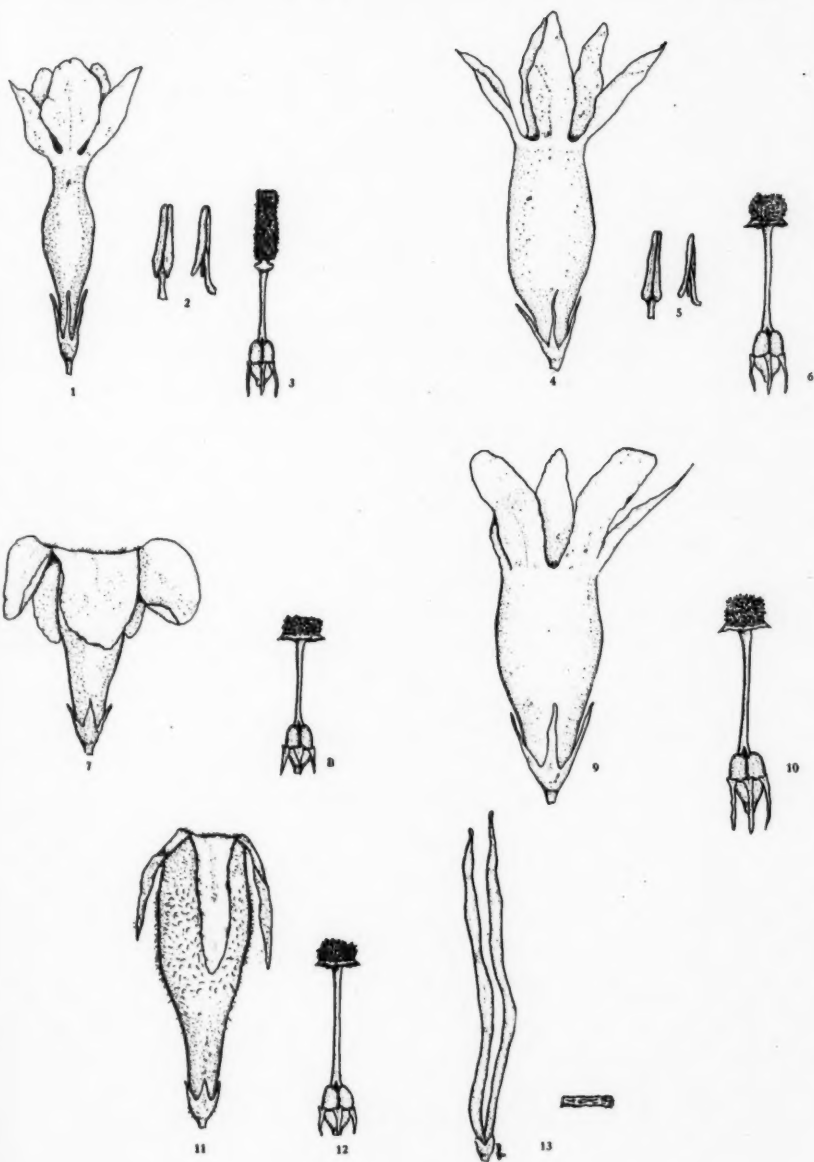
Fig. 10. Pistil.

A. Tabernaemontana Walt.

Fig. 11. Flower.

Fig. 12. Pistil.

Fig. 13. Follicles and seed. $\times \frac{1}{4}$.



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1951

1952

1953

EXPLANATION OF PLATE

PLATE 52

Illustrations of the subgenus *Sphinctosiphon*; all figures $\times 2$ except when otherwise noted.

A. Palmeri Gray.

Fig. 14. Flower.

Fig. 15. Pistil.

A. Standleyi Woodson.

Fig. 16. Flower.

Fig. 17. Pistil.

A. longiflora Torr.

Fig. 18. Flower.

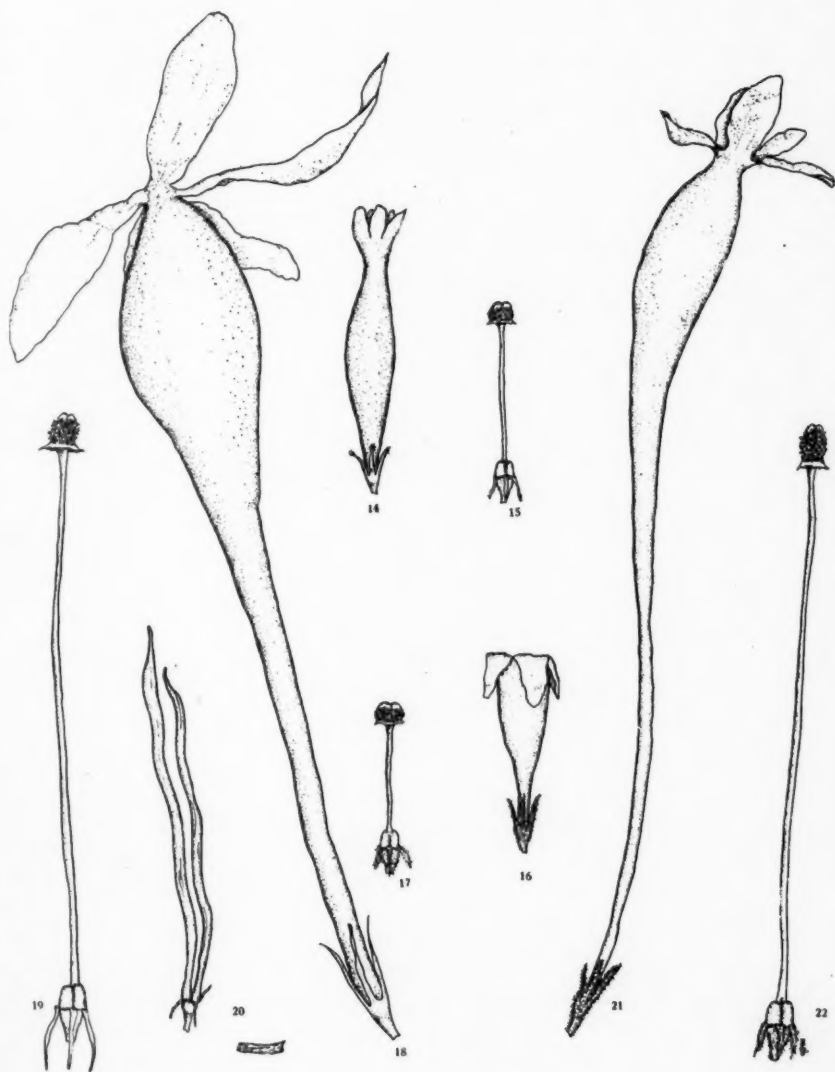
Fig. 19. Pistil.

Fig. 20. Follicles and seed. $\times \frac{1}{4}$.

A. salpignanthe Woodson.

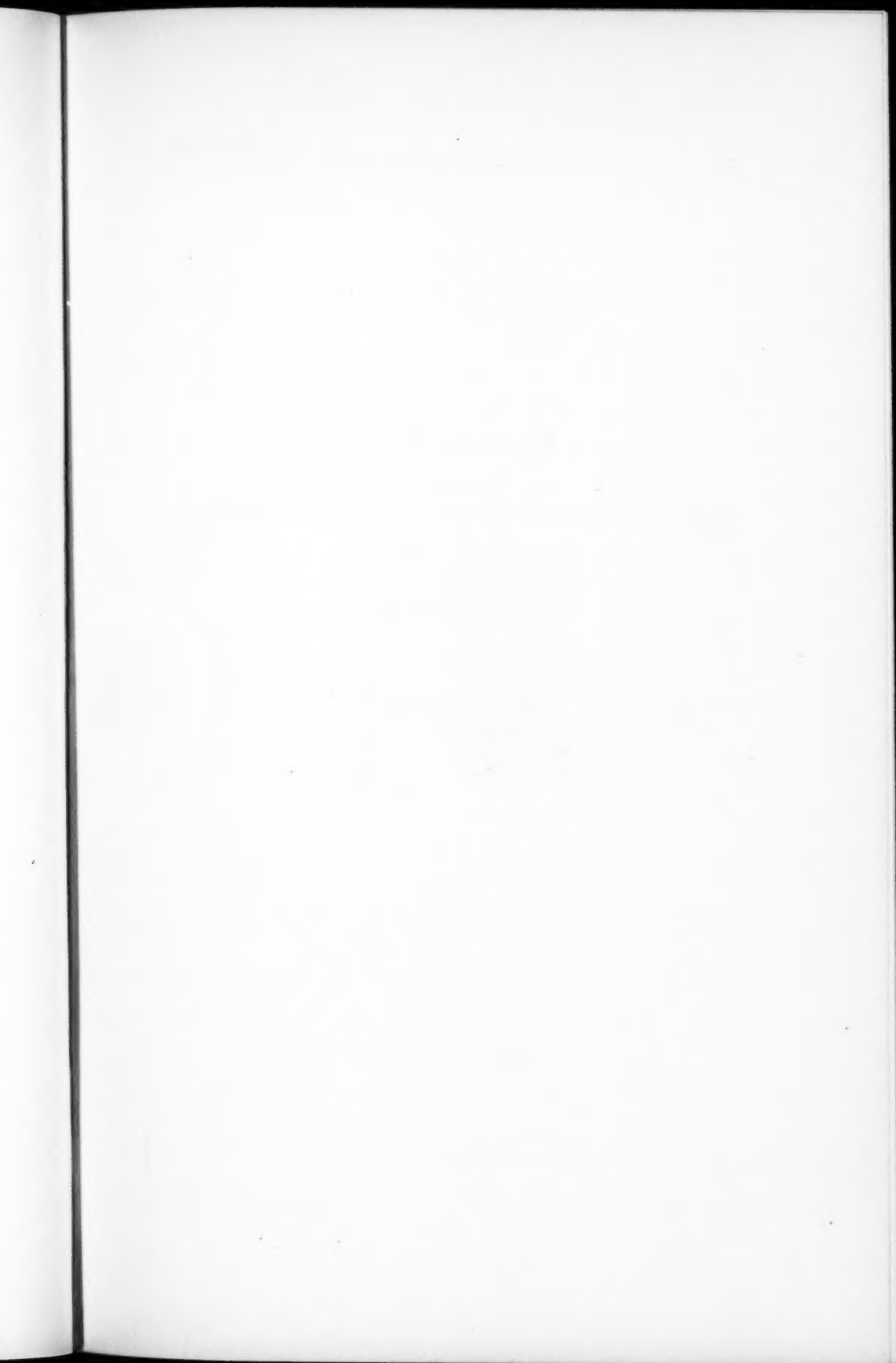
Fig. 21. Flower.

Fig. 22. Pistil.



WOODSON—STUDIES IN APOCYNACEAE





EXPLANATION OF PLATE

PLATE 53

Illustrations of the subgenus *Articularia*; all figures $\times 2$ except when otherwise noted.

A. tomentosa Torr. & Frém.

Fig. 23. Flower.

Fig. 24. Pistil.

Fig. 25. Follicles and seed. $\times \frac{1}{2}$.

A. brevifolia Gray.

Fig. 26. Flower.

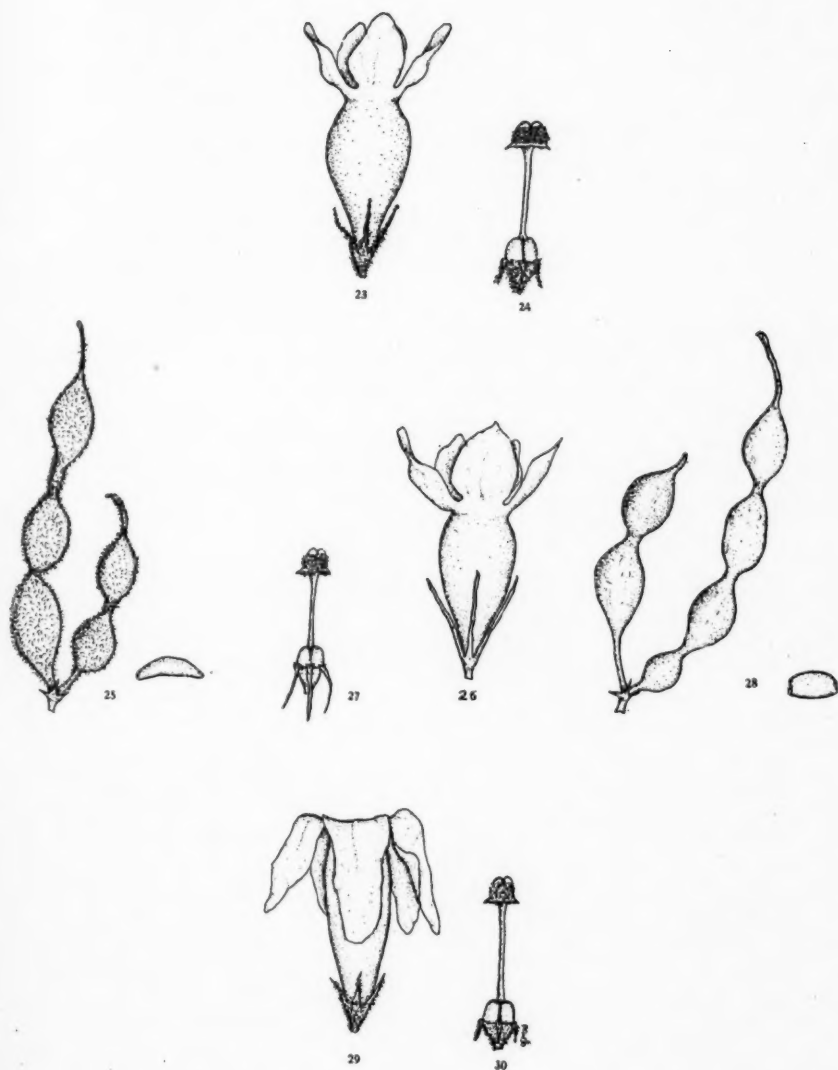
Fig. 27. Pistil.

Fig. 28. Follicles and seed. $\times \frac{1}{2}$.

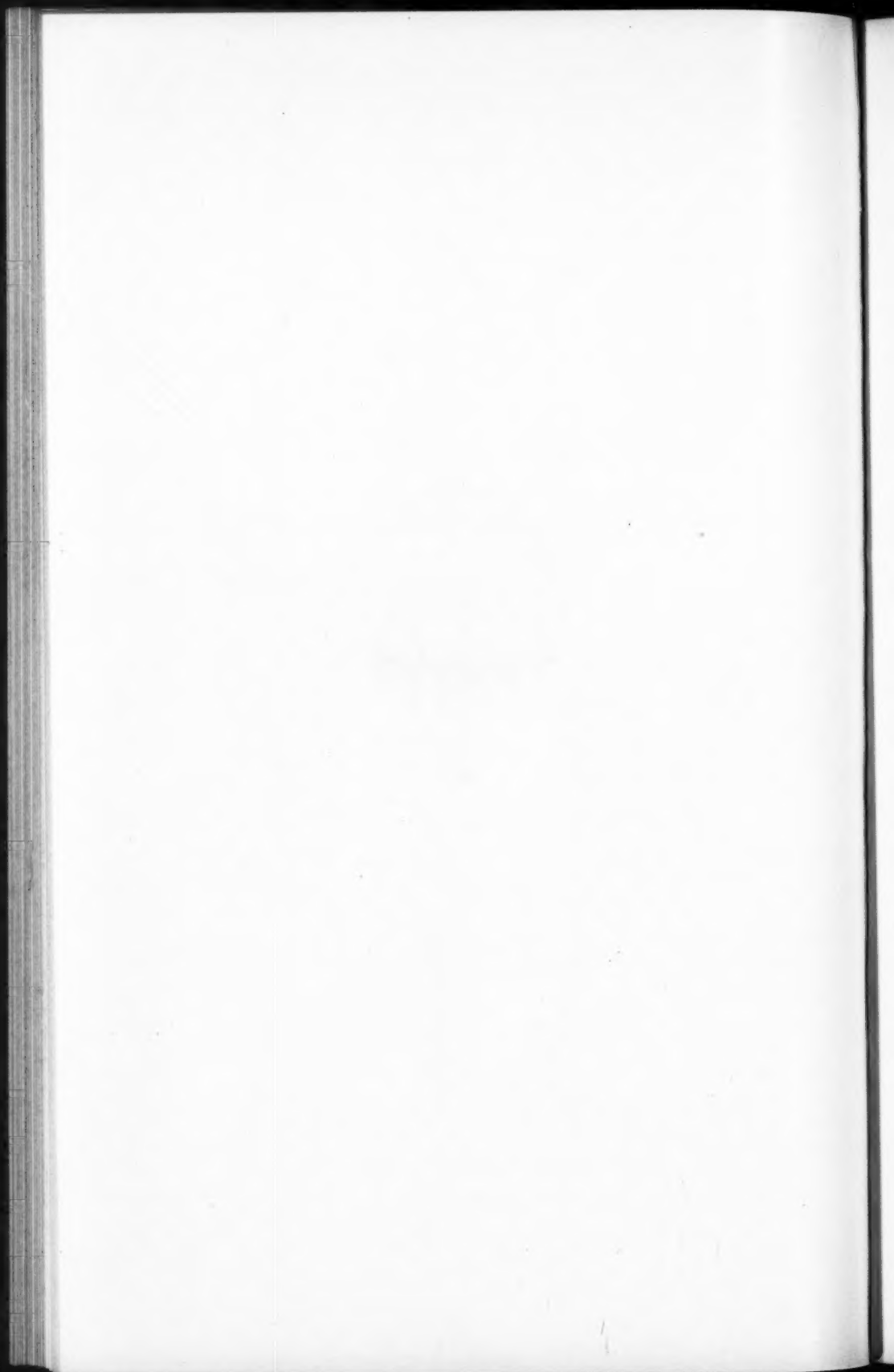
A. arenaria Standley.

Fig. 29. Flower.

Fig. 30. Pistil.



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